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THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE:

(WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE.")

A Journal of Practical Chemistry

IN ALL ITS APPLICATIONS TO

PHARMACY, ARTS, AND MANUFACTURES.

EDITED BY

WILLIAM CROOKES, F.R.S.

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THE CHEMICAL NEWS

VOLUME XV.

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WATER-SUPPLY OF TOWNS.

OUR readers will be interested in learning that the Queen has appointed the Duke of Richmond, Sir John Thwaites, Colonel Harness, Alderman Phillips, Thomas Elliot Harrison, Esq., and Joseph Prestwich, Esq., to be Commissioners for the purpose of ascertaining what supply of unpolluted and wholesome water can be obtained by collecting and storing water in the high grounds of England and Wales, either by the aid of natural lakes or by artificial reservoirs, at a sufficient elevation for the supply of the large towns; and to report—firstly, which of such sources are best suited for the supply of the metropolis and its suburbs; and, secondly, how the supply from the remaining sources may be most beneficially distributed among the principal towns.

After the elaborate investigation which took place in reference to this subject in 1851, resulting in a voluminous report, *et præterea nihil*, we confess we have not much faith in Commissions. Their recommendation may be excellent, but, like most good advice, it is seldom listened to. It is, however, to be hoped that public opinion is now sufficiently alive to the paramount importance of pure water to enforce the serious consideration of whatever improvements in our water supply the above Commission will be led to recommend.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Effect of Ammoniated Solution of Copper upon Vegetable Fibre, by WILLIAM SKEY, *Analyst to the Geological Survey, New Zealand.*

WHEN cotton in either the raw or the manufactured state is placed in contact with a strong solution of ammoniated copper, a notable portion is dissolved, and by boiling the solution, by exposing it to the air for a short time, or by the addition of an excess of acid thereto, a flaky gelatinous precipitate falls, which when dried acquires all the physical characters of air-dried hydrate of alumina. It is insoluble in water, alcohol, ether, nitric acid, or potash, and it easily burns, leaving but a small quantity of ash.

But the effect of ammoniated solution of copper upon vegetable fibre when wrought up into filter-paper is still greater—the fibres of the paper are seen to swell very considerably, and ultimately the whole of the paper is dissolved to a viscid adhesive mass of the consistence of treacle, completely soluble in cold water, but rendered quite insoluble in water by boiling it therein, by exposing it to the air, or by addition of acid as before.

The greater susceptibility of filter-paper to the action of ammoniated copper can no doubt be referred to the chemical changes certain to have been effected upon the fibre of the paper by the many processes to which it has been subjected.

What is the composition of the substance produced from fibre by this cuprous solution has not been ascertained; but from its characters here described it bears considerable resemblance to gum, especially to that variety named inulin.

On the Constancy of Composition of Compounds usually considered Stable, by Professor* J. S. STAS.

COMPOUNDS which have generally been considered stable have been lately found to be essentially unstable. M. Marignac proved in 1853 that the composition of normal sulphuric acid is only definite within a certain limit. Dr. Roscoe has since found that the composition of a great number of aqueous acids is a function of the pressure which the vapour of these acids supports when they are submitted to distillation. For my part, I have proved that chloride of ammonium, according to the circumstances in which it is produced, can condense either hydrochloric acid or ammonia, but I attributed this fact to a physical cause, and one consequently which is independent of the chemical action which determines the formation of chloride of ammonium. M. Marignac, starting from the fact he himself observed, suggests that the sulphide and nitrate of silver, of which I have given new syntheses, may contain the one an excess of sulphur and the other an excess of nitric acid. Sulphide and nitrate of silver, being essentially stable bodies, may be submitted to causes capable of eliminating the sulphur and the nitric acid that may have been accidentally retained in them. In examining the details contained in my work, insufficient as they may appear in the eyes of certain chemists, it may be readily seen that I have made every imaginable effort to get rid of this cause of error; and yet the results do not agree with the composition these bodies should have, according to the atomic weights of their elements deduced from the hypothesis of Prout. "It may be," says M. Marignac, "that the composition of these bodies is only definite within limits, or even that they do not contain their elements in the absolute ratios of their atomic weights." This doubt attacks both the usually admitted fact of the constancy of the composition

* Abstract from *Memoirs of the Royal Belgian Academy.*

of stable compounds, and the invariability of the ratios of the weights of the elements forming the combinations.

Although, among well-established facts, I have not been able to meet with a single one calculated to cause the adoption of the views of the celebrated Genevese chemist, yet I have considered myself bound, were it only out of deference to his opinion, to submit this question to a new examination.

Among the conditions which might conduce to render inconstant the composition of stable compounds, are found temperature and pressure.

When we examine the syntheses of chloride of silver, given in my work published in 1860, we see that this body, although it may have been produced in very different circumstances, presents a composition which I think should be considered as constant. I should not venture, in fact, to attribute the insignificant difference of the results to any other causes than to the inevitable error of observation. Yet, in some cases, the chloride of silver was produced at a red heat by the combustion of silver in chlorine, and, in other cases, at the ordinary temperature, by the precipitation, by means of hydrochloric acid, of silver dissolved in nitric acid. Here, then, the influence of heat seems to me to be absolutely nothing.

Can we attribute a disturbing action to the intervention of pressure? Known facts do not seem to me to justify this supposition either. In fact, in my syntheses of nitrate of silver, I have ascertained that this salt loses none of its weight when fused in a vacuum—in other words, that it is without appreciable tension.

Again, I think I have proved that nitrate of lead, a salt which is certainly at the extreme limit of bodies which can be considered stable, may be left in a vacuum for a whole day, at a temperature only differing by 55° from that at which it is decomposed at an ordinary pressure, without any sensible loss of weight.

In order to determine by new researches the question whether, in the formation of compound bodies, pressure and temperature have any influence upon the ratio observed between the elements which form them, I have renewed the determination of the mutual relation between silver and chloride of ammonium, which has already been the subject of such long investigations on my part. I have chosen this method for two reasons—first, because it allows of introducing as a condition of formation both temperature and pressure, and next because the operation may be executed with a precision bordering upon mathematical exactness.

The mutual relation between silver and chloride of ammonium deduced from experiment depends both upon the purity of the silver and upon the composition of the chloride of this metal and the chloride of ammonium, while the composition of the latter depends upon its purity. Now the determination may be made at the ordinary temperature or at 100°; we may therefore determine, with great exactness, if between these limits of temperature the composition of chloride of silver undergoes any change.

On the other hand, chloride of ammonium may be produced at the ordinary temperature or at a high temperature; in the latter case it may be volatilised at the ordinary pressure, or in a vacuum.

Lastly, the ammonia for the production of the chloride may be taken from different sources, which permits of our controlling the results by each other.

The researches I have already published have proved that 100,000 parts of silver equal on an average 49,594 parts of chloride of ammonium produced at the ordinary temperature or sublimed at the usual pressure by determining the proportional ratio at from 10° to 15° Centigrade. I have sought what would be the results by varying the conditions in the manner I have just shown. To this end I have produced chloride of ammonium by three different methods—viz., 1st. By the ammonia from commercial chloride of ammonium suitably purified; 2nd. By the ammonia from purified sulphate of ammonium; 3rd. By the ammonia produced from the reduction of nitrite of potassium.

I sought first if, under similar conditions, the results are identical for the different chlorides and the same as those that I formerly observed. In order to allow every one to judge of the care I have taken in making these new determinations, I will enter into all the necessary details both on the subject of the preparation of pure silver and the preparation of chloride of ammonium. I will first state the means I employed to procure pure silver, and the precautions I took to make certain of the degree of purity of this metal. However lengthy these details may be, I think it is necessary, since this same metal enters into the syntheses of bromide, iodide, and nitrate of silver, of which I shall have to give an account in the notices on these subjects.

On the Preparation of Lime Crucibles for great Heats, by David Forbes, *F.R.S., &c.*

As a means of preventing the introduction of carbon and silicon into metals and alloys during the process of fusion, Deville some years back recommended the employment of crucibles turned in the lathe out of solid blocks of caustic-lime. The results of experiments made with such crucibles were found to be extremely satisfactory, and metals fused therein, as iron, manganese, nickel, cobalt, &c., were obtained far purer and more malleable and ductile than when fused in the usual clay or brasque crucibles. Unless, however, the crucibles required were of very small size, it was found difficult to obtain blocks of lime for shaping them sufficiently large and free from flaws; and experiment showed a considerable loss, both by breakage when shaping them and by their cracking when in the furnace. In order to obviate this, trials were made with clay crucibles lined with lime, but ineffectually, as these crucibles invariably melted down before the requisite heat was arrived at—a result due to the action of the lime itself upon the clay outer crucible.

After a number of experiments the following arrangement was found fully to answer the purpose, being capable of standing the heat of melted wrought iron or cobalt without fusion or cracking, as well as of being made of any reasonable size:—

A clay crucible of somewhat larger capacity than the desired lime one is filled with common lamp-black, compressing the same by stamping it well down. The centre is then cut out with a knife until a mere shell or lining of lamp-black is left firmly adherent to the sides of the crucible, and about half an inch or less in thickness, according to the size of the crucible; this lining is now well rubbed down with a thick glass rod until its surface takes a fine glaze or polish, and the whole cavity is then filled up with finely-powdered caustic lime and pressed down as before, and a central cavity cut out as before; or the lime-powder may be at once rammed down round a central core of the dimensions of the intended lime crucible.

This lime lining is naturally rather soft before being placed in the furnace, but upon heating agglutinates,

and forms a strong and compact crucible, which is prevented acting upon the outer one by the interposed thin lamp-black layer, and at the end of the experiment generally turns out as solid and compact as those made in the lathe.

Experiments made with such crucibles, even up to dimensions containing several pounds of metal, have proved them extremely well suited for these operations, and doubtless similar crucibles could be made lined with magnesia or alumina as required. In some cases ordinary black-lead crucibles lined with powdered lime, magnesia, or alumina, might possibly be found to answer.

TECHNICAL CHEMISTRY.

New Facts concerning Amalgamation, by M.* J. Nickles.

The action which mercury exercises on metals is not so energetic as that of sodium amalgam. This difference may be proved in a very simple manner, and in such a way as to be easily laid hold of by any audience.

Let a sufficiently large square of glass be taken, upon which, side by side, two gold leaves are cemented. If a drop of common mercury is conveyed to one of these leaves, the drop will be seen to adhere to it, and become flat, without increasing perceptibly in extent. Let a precisely similar operation be performed with a drop of sodium amalgam, and the drop will be observed to extend with astonishing rapidity, eating away and whitening all around it. In less than a few seconds the mercury will thus have obtained a superficies which many hundred times exceeds the section of the original drop.

In acting thus on gold leaf, the mercury sometimes creates a gap by drawing away the gold which it has met with and amalgamated by the way; sometimes, on the contrary, the precious metal remains in its place while amalgamating, and the square seems to be silvered on the points where the stationary amalgamation has taken place.

The spreading of the mercury on the surface of the metallic leaf does not always happen concentrically. It may have taken place in one direction rather than another, whether on account of the cohesive solutions which occur, or because the surface of the molecules does not everywhere present an equal degree of purity, especially when the metallic leaf has been put on with a cement.

This action of sodic mercury takes place even against gravitation, for it is not necessary that the gold-leaf should affect a horizontal position in order to be whitened in every way; the phenomenon is produced even when this leaf is placed vertically, so that the mercury may be seen rising along the metallic surface whitening or eating it away, continuing at the same time its work in a downward direction. Amalgam of thallium acts in the same manner.

This curious experiment does not succeed so well with silver, or beaten copper leaves, either because they are not so thin as those of gold, or because the permeability for mercury is less great in silver and copper than in gold. This question, to which I formerly applied myself, becomes complicated, besides, from the physical state of the metal; a piece of copper of a certain thickness takes less time to be penetrated with mercury and become brittle than a copper-leaf which has been reduced by laminating to the condition of tinsel, evidently because in the former case the metal is far more porous than in the latter.

It does not follow that because iron and platinum are not wetted by mercury they are incapable of uniting with it. The amalgam of iron and that of platinum are known; only, to obtain them, it is necessary to have recourse either to the battery or to a more electro-positive metal. Thus, to amalgamate iron, the metallic sheet has only to be rubbed with a zinc or brass brush, dipped in acidulated water, and a drop of mercury added. Here amalgamation takes place, by virtue of a galvanic effect, produced by a metal which, like sodium or zinc, is more positive than iron; in every case it remains superficial, the mercury not penetrating into the metal serving as substratum. Then it is also understood that amalgam of sodium can mercurise iron and platinum. I have made some remarks on this point, the results of which are as follows:—Amalgam of sodium promptly attacks a leaf of platinum cemented on glass; wherever this amalgam has touched, a hole is made. It is the same with leaves of aluminium. The same amalgam wets and instantly mercurialises a platinum crucible; but the metallic sheet is not permeable by it, for after six months' contact it had retained all its flexibility, and had not become brittle, as with iron and other metals not permeable by mercury; amalgamation remained superficial.

Ribbon magnesium, such as is used for lighting, is little affected by mercury; it is, without doubt, a little wetted by it under the influence of acidulated water; but amalgam of sodium is without action on it. However, thallium is wetted by mercury, and becomes brittle under its influence, thus resembling other metals, such as zinc, tin, lead, copper, silver, gold, and their alloys.

Laminated magnesium and thallium were not known thirteen years ago, when the aforesaid researches were published; their behaviour with respect to mercury adds, then, one more proof to the correctness of the proposition made at that time—viz., that "the metals which are wetted by mercury are permeable to it, and those which are not wetted are not penetrated by it."

To this proposition we may add that "when metals, which are not wetted by mercury, have been amalgamated by an indirect method, the mercury remains on the surface, does not penetrate into the depth of the metal, and consequently does not render it brittle."

It would be curious to prove the behaviour of indium in this respect; I submit the question to anybody who is fortunate enough to be possessed of this rare metal.

* *Journal de Pharmacie et de Chimie*, vol. iv. p. 330.

Action of Chlorine on Amylene.—M. Bauer, in an article in *Zeitschr. Chem.* p. 380, stated that at 17° C. chlorine is absorbed by amylene without any sensible disengagement of hydrochloric acid; at the boiling point the disengagement takes place, and at the same time there are separated—1. Chlor-amylene, $C_{10}H_9Cl$, boiling from 90° to 95° C. 2. Chloride of amylene, $C_{10}H_{10}Cl_2$. 3. Chlorinetted chloride of amylene, $C_{10}H_9Cl_3$, crystallising in camphorated masses. 4. Bichlorinetted chloride of amylene, $C_{10}H_8Cl_4$; a heavy limpid liquid, boiling at 230° to 240° C.

Iodine in Mineral Phosphates.—In trying an experiment with about half a ton of German phosphate of lime and sulphuric acid, I was astonished to see a very considerable evolution of iodine fumes. Having some misgivings on account of the novelty of the phenomena (to me), I exposed a sheet of paper smeared over with starch to their influence: the test was undeniable. Is this fact known to iodine manufacturers?—Smatterer.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, December 20.

DUGALD CAMPBELL, *Esq., in the Chair.*

THE minutes of the previous meeting were confirmed, and the donations to the library announced. Dr. E. A. Cook and Mr. James Forrest were formally admitted Fellows of the Society, and the following gentlemen were duly elected —viz., John Broughton, B.Sc., Chemist to the Government Cinchona Plantation, Madras Presidency; Mr. Watson Smith, 26, Portland Crescent, Manchester; and Mr. Walter Noel Hartley, Pathological Laboratory, St. Thomas's Hospital, London. The candidates proposed, whose names were read for the first time, were James William Hudson, Ph.D., Principal of Trafford College, Manchester; Mr. Joseph Ince, 26, St. George's Place, Hyde Park Corner; Mr. George Ottley, 196, Walworth Road.

Mr. W. H. PERKIN read a paper "*On the Basicity of Tartaric Acid.*" From the previous results of Hugo Schiff, Fritzsche, and others, tartaric acid is assumed to be tetrabasic; but the author has arrived at a different conclusion —viz., that it has a *bibasic* character, being, however, tetratomic, founding his opinion upon the study of certain new derivatives obtained from tartaric ether by the action of the chlorides of benzoyl, acetyl, and of other acid radicals. Of the two pairs of hydrogen atoms in tartaric acid, one only is replaceable or "basic," whilst the remaining couple possess very different functions, or are such as have been designated "alcoholic hydrogen." Some idea may be formed of the main points of this elaborate investigation from a notice of the several instances of replacement successfully accomplished:—

Benzo-tartaric Ether.—Acting with chloride of benzoyl upon tartaric ether, the author succeeded only in replacing one atom of hydrogen by benzoyl. This product, treated with dilute alcoholic potash, gave a crystalline body—ethyl-benzo-tartaric acid—besides Dessaignes's benzo-tartaric acid.

Similar results were obtained with paratartaric ether and chloride of benzoyl. The action of chloride of succinyl upon tartaric ether furnished an oily body containing two equivalents of tartaric ether bound together by the replacement of H_2 by diatomic succinyl. It is appropriately named succino-tartaric ether.

Aceto-benzo-tartaric Ether.—It was found to be possible to replace the two atoms of hydrogen in tartaric ether, the one by benzoyl, and the other by acetyl, giving rise to this body.

Aceto-tartaric Ether was formed by the replacement of one of hydrogen; and

Diaceto-tartaric Ether by two of hydrogen in the original body by the action of appropriate amounts of the chloride of acetyl. This second substance underwent no further change when brought in contact with sodium, tending to show that all the replaceable hydrogen had already been substituted in this compound.

Some interesting theoretical considerations bearing upon the constitution of paratartaric acid were next mentioned; after which Mr. Perkin described the results he had obtained by acting upon chloride of acetyl with dry tartaric acid. In this reaction a splendid crystalline substance was formed, which corresponded to the diaceto-tartaric anhydride; and from dried paratartaric acid an identical product was more slowly obtained.

Diaceto-tartaric Acid was formed from the last-named product by the action of water. It is a powerful acid, of bibasic character, forming two classes of salts—acid and neutral—many of which have been examined and described. The author alludes to Rochleder's previous notice of this substance and some of its salts in 1859.

Sodio-tartaric Ether and the disodium compound were prepared by the action of the alkali-metal upon tartaric ether, and the first of these gave, on treatment with iodide of ethyl, an oil, probably ethyl-tartaric ether.

The views advanced by the author in explaining the constitution of some of his new derivatives, were briefly remarked upon by Dr. WILLIAMSON; and

The PRESIDENT moved a vote of thanks to Mr. Perkin for his interesting communication.

A paper, in continuation of a previous research, and entitled "*On the Absorption of Vapours by Charcoal,*" by JOHN HUNTER, M.A., was read by the SECRETARY. The author has determined the rate of absorption of various substances in the state of vapour by a known bulk of cocoa-nut charcoal. The results for different temperatures are indicated in a series of tables. The following bodies were operated upon:—Aniline, carbolic acid, hydride of benzoyl, butyric acid, butyric ether, oil of turpentine, valerianic acid, aldehyde, acetic ether, acetone, nitrous ether, hydrochloric ether, formic acid, amylene, and perchloride of carbon.

Mr. E. T. CHAPMAN then read a paper "*On Some Reactions of Hydriodic Acid.*" The author referred to a previous paper, in which he stated that nitrite of amyl is decomposed by hydriodic acid, yielding nitric oxide and iodide of amyl. He has determined the amount of nitric oxide liberated under these circumstances, and finds it considerably short of the theoretical quantity. In fact, owing to a secondary reaction, a portion of the nitric oxide is converted into ammonia. When the amount of nitrogen present in the form of ammonia is added to that in the nitric oxide, the two are found to be exactly equal to the total amount contained in the nitrite. He finds that he can convert nitric oxide into ammonia by the action of boiling hydriodic acid. He has also determined the amount of nitric oxide liberated by the action of sulphuric acid on nitrite of amyl, and proved that the whole of the nitrogen is in this case obtained in the form of nitric oxide. The nitrates of the alcohol radicals appear to be decomposed by hydriodic acid in the same manner as the nitrites, though not so readily; the products being the iodide of the alcohol radical, nitric oxide, ammonia, and water.

Mr. HERBERT MCLEOD exhibited and described a very ingenious and efficient apparatus intended to serve the purpose of a *continuous aspirator*. After describing the arrangements in common use, and the leading features of his own invention, the author stated that, with a uniform pressure of water, the instrument acted with the regularity of a water-clock. It would be impossible to convey a correct idea of the instrument without resorting to pictorial illustration.

The PRESIDENT then adjourned the meeting until Thursday, January 17.

ACADEMY OF SCIENCES.

December 10.

"*Reply to the Critical Observations of M. Spierer relative to the Parallax of the Depths of the Solar Spots,*" by M. Faye.

"*On Chirurgical Intoxication,*" by M. Maisonneuve.

"*On the Longitude of Rio de Janeiro,*" by M. Mouchez.

"*On Molecular Forces in Liquids in Movement, with their Application to Hydrodynamics,*" by M. Kleitz.

"*Application of the Diapason to Horology,*" by M. Maudet-Breguet.

"*On the Poisonous Principles in Cholera Dejections,*" by M. C. Thiersh.

"*Observations on Dialysis and Endosmose,*" by M. Dubrunfaut.

"*On the Reciprocal Actions of Hydrocarbons,*" by M. Berthelot. In continuation of his researches on the mutual action of hydrocarbons, the author has examined the action of ethylen on phenyl, chrysen, and anthracen, and the action of free hydrogen on chrysen, naphthalin, and

anthracen. A mixture of ethylen and phenyl passed simultaneously through a red-hot tube yields, on the one hand, benzol and styrol (displacement of benzol by ethylen)—

$$C_{12}H_4(C_{12}H_6) + C_4H_4 = C_{12}H_4(C_4H_4) + C_{12}H_6,$$

and also anthracen and hydrogen (displacement of hydrogen by acetylen)—

$$C_{12}H_4[C_{12}H_4(H_2)] + C_4H_2(H_2) = C_{12}H_4[C_{12}H_4(C_4H_2)] + 2H_2.$$

Ethylen and chrysen passed simultaneously through a hot tube produce principally anthracen and a little naphthalin by displacement of the benzol. Ethylen and anthracen form a large quantity of naphthalin. The reactions of hydrogen are less characteristic. Hydrogen and chrysen give rise to benzol and phenyl. Hydrogen and naphthalin scarcely react upon one another, and the action between hydrogen and anthracen is still more difficult, traces of benzol and acetylen being formed in each case. The author deduces from his researches the law that in these reactions there is a reciprocal change between the hydrogen, benzol, and ethylen, regulated by the relative masses of these three bodies. The study of reten has led the author to some new facts. He considers it to be a homologue of anthracen. The reaction of formen on benzol was not attended with success. It was only at the softening point of porcelain that the commencement of reciprocal action was observed, attended by the production of a minute quantity of anthracen and naphthalin.

"*On Some Properties of Chloride of Sulphur*," by M. Chevrier. The author has studied the action of phosphorus on chloride of sulphur, and has succeeded in converting it almost entirely into chlorosulphide of phosphorus. In a large globe of seven or eight litres' capacity, pour three equivalents of chloride of sulphur SCl, and heat to the boiling point. Then add in small fragments one equivalent of phosphorus. After each addition well agitate the vessel; the result will be a yellow liquid consisting almost exclusively of chlorosulphide of phosphorus, holding sulphur in solution. Distil, rejecting the small portion which comes over below 125° C., the boiling point of chlorosulphide of phosphorus. The reaction is—

$$P + 3SCl = PCl_3S + 2S.$$

The author has prepared half a litre of this body in one day. An attempt to prepare chlorosulphide of arsenic failed. Upon working in identically the same manner, only chloride of arsenic and sulphur were produced—

$$As + 3SCl = AsCl_3 + 3S.$$

The author has here observed a curious fact connected with the crystallisation of sulphur. Towards the end of this operation, the yellow liquid on cooling deposits long prismatic needles of sulphur, amongst which are easily distinguished octahedra of relatively considerable volume. The prismatic sulphur is opaque; the octahedra are, on the contrary, very brilliant. They appear to form only towards the end of the cooling. The experiment is very easy to repeat, and each time it gives the same mixed crystallisation. In 1848 M. Pasteur observed an analogous fact in the preparation of sulphide of carbon.

"*On the Direction of the Vibrations in Polarised Light*," by M. Mascart.

"*On the Analysis of the Soluble Principles of Vegetal Earth*," by M. Schlösing. The researches of Messrs. Huxtable, Thompson, Way, &c., have shown that soils have an absorptive power, ranging according to their nature, for alkalis, but that this power is *nil* for hydrochloric, nitric, and sulphuric acids. The author has confidence in this displacement method when acids are to be determined in the solution which nourishes vegetables; but as regards the alkalis, the method yields a minimum result only. Indeed, if equal weights of earth are soaked with solutions of alkaline salts identical in composition but unequal in volume, that portion of earth which is in the presence of the greatest volume will absorb the most alkali. Thus, when the author employs the method of displacement, he accumulates in the lower layers, solutions of alkaline salts. He, therefore, permits the earth to take up more alkali than it had before, and impoverishes his solutions. That does not prevent the establishment of a new equilibrium, whence results the constancy of composition of the first liquids collected. New researches are, therefore, necessary to determine the amount of this impoverishment, which evidently varies according to the nature of the soil.

"*Note on Crystallised Oxalate of Lime*," by M. Monier. The author has obtained crystallised oxalate of lime by carefully reversing a vessel containing a dilute solution of oxalic acid into a denser bath of sucrate of lime. Owing to the difference of density, the oxalic acid rests without mixing on the alkaline solution, and slowly combines to form a well-crystallised salt. Ammoniaco-magnesian phosphate may be obtained in a similar manner.

December 17, 1866.

"*On the Parallactic Inequality of the Solar Spots*," by M. Faye.

"*On the Periodical Variations of Temperature in February, May, August, and November*," by M. C. Sainte-Claire Deville.

"*On the Composition of the Stone Implements found in Celtic Monuments and amongst Savage Tribes*," by M. A. Damour.

"*New Theory of Crystalline Reflection, according to Fresnel's Ideas*," by M. A. Cornu.

"*On the Selenides from the Mines of Cacheuta*," by M. Domeyko. A deposit rich in selenides was discovered about six years ago, at Cacheuta, in the province of Mendosa, at the lower part of the Andes. The seleniferous minerals have as yet only been found in one vein, the direction of which is nearly north and south, and the angle of inclination 90°. It intersects the system of stratification at almost a right angle. The author has been led to the conclusion that there are three associated minerals mixed in different proportions—first, a selenide analogous to eukairite $(Ag,Cu)Se$; secondly, $(Fe,Co)Se$; and, thirdly, $PbSe$. The first two possibly form a polyselenide whose composition approaches the formula $(Fe,Co)Se + 2(Ag,Cu)Se$, and in which the selenide of silver and subselenide of copper, which are isomorphous, replace one another, as do the sulphide of silver and subsulphide of copper in the double sulphides of Chili. These selenides have great outward similarity; their hardness is 2·5, and their density from 6·3 to 7·2. They are very fusible, and before the blowpipe give the characteristic odour of selenium. In a closed tube, black and red selenium sublimes. In an open tube they give variable proportions of selenious acid mixed with a reddish sublimate. Nitric acid attacks and dissolves these minerals easily with liberation of selenium, which disappears on boiling. Pure and hot hydrochloric acid also attacks these selenides with evolution of part of the selenium as seleniuretted hydrogen. The best method of analysis was found to be separation of the selenium by means of dry chlorine, and the lead and silver by dissolving in nitric acid, and precipitation by hydrochloric and sulphuric acid. The percentage of selenium varied between 22·4 and 30·8 per cent.

"*On the Spontaneous Generation of Infusorial Animalcules*," by M. A. Donné.

"*Observations on the Previous Note*," by M. Pasteur.

"*On the Reciprocal Action of Hydrocarbons*," by M. Berthelot.

"*On the Seeds of Buckthorn, from a Chemical and Industrial Point of View*," by M. J. Lefort. This is a continuation of a paper which we noticed some weeks ago. The object of this new memoir has been to find out under what circumstances rhamnegine passes into rhamnine; to show

how each of these acts in the dyeing of tissues, and how these two colouring matters may be industrially utilised. The author finds that rhamnine, which is so easily separated from buckthorn, and which has not hitherto been used, will yield clearer yellows than will rhamnegine.

"*On a New Hydrocarbon*," by MM. C. Friedel and A. Ladenburg. Certain theoretical considerations, and the existence of a compound in which four hydrocarbon groups C_2H_5 are united by one atom of silicium, led the authors to seek for a hydrocarbon having an analogous constitution. After many fruitless efforts they succeeded, by acting on methylchloracetol with zinc ethyl, in preparing a hydrocarbon, C_7H_{16}, which they represent by the formula—

$$C\begin{cases}2CH_3\\2C_2H_5\end{cases}$$

The new body boils between 86° and 87° C. Its vapour density is 3·62, and its specific gravity at zero is 0·7111.

"*On Some New Derivatives of the Fatty Acids*," by M. H. Gal. The author has prepared monacetyle-glycolic ether; monacetyle-butyllactic ether; monobutyrile-butyllactic ether; and several other bodies.

NOTICES OF BOOKS.

Inorganic Chemistry. By the late George Wilson, M.D. Revised and enlarged by Stevenson Macadam, Ph.D. With New Notation added. W. and R. Chambers.

This is a new edition of a work published by the late Dr. Wilson sixteen years ago, which the rapid progress of the science has necessarily rendered obsolete. Large alterations and additions to it have been made by Dr. Macadam, with the view of bringing it up to the present state of the science, but we cannot congratulate him on the mode in which he has performed his task. In place of being a clear and concise, though very elementary, sketch of the state of the science, as the original work at the date of its publication certainly was, the present edition abounds in loose and inaccurate statements.

As an illustration, we may quote the well-known definition of atom and molecule, which is given in these words:—

"An *atom* of a substance is the smallest proportion which will combine with other particles of matter, but which cannot exist in a separate form. *Molecules* are the smallest portions of matter which can exist in a separate state. Thus, an *atom* of water is the least quantity which will combine with other substances; whilst the *molecule* of water is the smallest proportion which will exist by itself, and which might be obtained by the ultimate division of a portion of water."—Page 14.

In which passage the illustration is not only entirely erroneous, but renders the definition itself perfectly unintelligible.

In the chapter on the Laws of Combination by Volume, on which the whole system of modern chemistry is founded, numerous errors exist. We are told for example that—

"No elementary substance yields a greater volume than hydrogen, but the compound gases and vapours give one twice as great as that of this gas. They have, accordingly, placed after them a double square | | , which has twice the capacity of that of the simple or elementary substances."—Page 70.

From which we must infer that the editor is ignorant of the fact that the atoms of cadmium and mercury occupy twice the volume of an atom of hydrogen. We might have supposed this to be an omission; but in the table in the previous page, mercury is set down as occupying one volume, and among the experimental vapour densities that of mercury is given as 201·11, which is just double the number actually found.

The statement regarding the volume of compound gases is curiously inconsistent with the following passage which appears on the next page:—

"The vapours of organic substances afford examples of both classes. No organic substance yields a vapour less than that of hydrogen or one volume. The organic substances which play the part of simple bodies, and thus combine together, or with other substances, like elementary bodies, have a combining volume similar to that of hydrogen, namely, 1 or | | , and an example of this class is ordinary ether (!); whilst other organic substances, which conduct themselves like compounds, such as hydrochloric acid, have a double combining volume, namely, 2 or | | ; and an illustration of this group is the vapour of alcohol."—Page 71.

While, as if to make confusion worse confounded, on the page immediately following, ether is represented as occupying two volumes.

The descriptive part of the work is equally inaccurate; in proof of which we select the account of Nordhausen sulphuric acid:—

"Green vitrol consists of sulphuric acid, oxide of iron, and water, its exact composition being $FeSO_4+7H_2O$. It is first strongly dried, the effect of which is to expel the greater part of the water it contains. About a seventh part of that, however, is always, and purposely, retained. The dried sulphate of iron is then exposed to a red heat in stoneware retorts. Half of the sulphuric acid of the sulphate comes over in combination with water, whilst the other half is decomposed into sulphurous acid, which is evolved as gas, and oxygen, which converts the protoxide of iron into peroxide.

"Nordhausen acid varies in strength, but when strongest may be regarded as consisting of one combining proportion of water, and two of sulphuric acid, H_2O+2SO_3 [by old notation, $HO+2SO_3$]. It is twice as strong as the strongest English sulphuric acid, or oil of vitriol."—Page 161.

The merest tyro in chemistry must see that, if one-seventh of the water of the green vitriol is retained, no Nordhausen acid can be got, but that the product must be the glacial acid $H_2SO_4H_2O$.

Our readers will probably be interested to know, on the authority of Dr. Macadam, that there are three compounds of hydrogen and oxygen, one having the formula H_2O_3; that the air dissolved in water consists of two volumes of oxygen to one volume of nitrogen, and not of 1·87 of nitrogen to 1 of oxygen, as we had previously supposed; that olefiant gas is CH_2, and that this quantity occupies two volumes; that hypophosphorous acid is HPO, and not HPH_2O_2, and that the calcic hypophosphite is CaP_2O, which is not even consistent with the formula given for the acid; that nitrate of copper, according to the new notation, contains six molecules of water of crystallisation; and that, by calcination in a current of air, galena "is converted in part into sulphate of lead, $PbSO_4$, and by subsequent *increased heat the whole is reduced to the state of metal.*"

These are but a few examples of errors and inaccuracies which abound in almost every page of this work, and make it a most unsafe guide for the student.

At the present time, when the study of chemistry is being slowly introduced into elementary schools, it is especially necessary to keep a watchful eye on the character of the manuals likely to be used, for it is manifest that the success of the movement must greatly depend on their accuracy and precision. In these qualities the work before us is eminently deficient, and we have thought it necessary to point out its shortcomings very distinctly, because, from its being one of an "Educational Course" published by Messrs. Chambers, it is not unlikely to find its way into the hands of teachers whose knowledge of such subjects is necessarily often but little in advance of the text-books they use, and who may not be able to detect its errors.

CHOLERA AND ANTISEPTICS, 1866.

(A) *The Arrest and Prevention of Cholera; being a Guide to the Antiseptic Treatment.* By A. E. Sansom, M.B. Lond. London: Churchill.

(B) *Asiatic Cholera.* By F. A. Burrall, M.D. New York: Wm. Wood and Co. London: Stevens Bros., Covent Garden.

(C) *Reprint from the Appendix to the Third Report of the Cattle Plague Commission.* By Wm. Crookes, F.R.S. London: J. H. Dutton, 1, Wine Office Court, Fleet Street.

(D) *Tenth Annual Report of the Medical Officer of Health for the Holborn District Board of Works, London.*

(E) *Handbills relating to Precautions to be taken against the Cholera.* Various.

(*Continued from Vol. XIV., page 262.*)

It is generally stated that there is a diminution in the quantity of ozone during cholera epidemics, just as an excess is found in an epidemic of influenza. The latter fact seems to be better established than the former. Of other disinfectants recommended by medical officers and chemists we may notice the following:—

Heat.—Dr. Frankland denies that a boiling heat destroys the vitality of the cholera germ. This is not generally agreed with, and, if true, would upset the doctrine of the disease being due to organised particles, since nothing of the kind could long resist a heat of 212° F. An obvious fallacy is difficult to be guarded against, for if water be so treated, and the noxious germs destroyed, it is after such treatment still exposed to germs in the atmosphere. However this may be, boiling is almost universally recommended for the disinfection of water, and was so during the late epidemic almost without exception. The poison of scarlet fever (inferior to few in point of virulence) is well known to be destroyed at a temperature of 220° F. Speaking of disinfection generally, Dr. Tanner observes: "Woollens, bedding, or clothing may be thoroughly purified by exposing them for about two hours in an oven at a temperature of 220° F."

Solution of chloride of iron is named as one of the chief disinfectants, with chloride of lime, Burnett's fluid, and Condy's liquid, in the memorandum drawn up by the metropolitan medical officers of health. We presume that this is meant to replace the sulphate, as recommended by Pettenkofer, for the disinfection of drains. "Sulphate of iron or a solution of carbolic acid" is recommended for the district of St. Giles, Camberwell. Professor Roscoe and Dr. Noble recommend the following for the township of Manchester:—

"*As a disinfecting liquid,* a neutral solution of the chlorides of manganese and iron (the neutralised refuse liquor from the manufacture of chlorine), called in the report 'the disinfecting fluid.'

"*As a disinfecting powder,* chloride of lime or bleaching-powder, called in the report 'the disinfecting powder.'

"These substances are selected (1) because they are known to be efficacious; (2) because they can be obtained in the necessary large quantities at a moderate cost; and (3) because the mode of their employment is simple.

"Other substances may possibly act as effectively, but these are chosen as best suiting the present purpose.

"The 'fluid' is to be used chiefly for general disinfection, by the authorities, of the drains and sewers of the low-lying and suspected neighbourhoods. *One gallon of the 'fluid' will disinfect* 10,000 *gallons of ordinary sewage.*

"The 'fluid' is also to be used for special disinfection of the house drains, &c., when needed.

"The 'powder' is to be used for the special disinfection of linen, utensils, bedding, and dwelling-houses, as hereafter described. *One pound of this powder will disinfect* 10,000 *gallons of ordinary sewage.*"

From the following paragraph of this same handbill we should think that the sewage state of Manchester is by no means perfect.

"*Discharges from the Sick.*—Two tablespoonsful of the 'powder' to be at once distributed over the contents of the vessel, which must then be covered and at once emptied. These discharges, even after disinfection, must on no account be thrown out into *middens, privies, or sludgepools* in the neighbourhood of the dwelling-houses but got rid of through the *street drains,* which must be frequently disinfected and flushed as suggested. *Where there are water closets these would of course be used in preference to the street drains.*"

If sludgepools are the same as our cesspools, such a fact may account for the unhealthiness of Manchester in part, for in London there are *very few* cesspools now, while the drainage and sewage of Birmingham is still better. Thus, from the report on the "Health of London" for October 27, 1866, we find the rate of mortality for the week was

22	in	1000	for Birmingham,
24	"	"	London,
30	"	"	Manchester,
32	"	"	Liverpool;

and this relative order is tolerably constant.

Many salts that fix noxious gases we find not mentioned, such as the acetates of copper and lead. Theoretically, for the destruction, or rather fixation, of sulphuretted hydrogen, common Goulard water would have been thought to be most useful, but sulphate and chloride of iron seem to be generally preferred for the purpose. This probably acts by virtue of the persalt of iron present oxidising the sulphuretted hydrogen. Of gaseous disinfectants and antiseptics the lower oxides of nitrogen seem to have been replaced entirely by hypochlorites, and justly so, for the preparation of the latter is much more easy, and the gas also, or mixture of gases, evolved is less irritating.

Iodine also deserves a fair trial, since its properties of acting on morbid products are well known to be very different from those of chlorine, and such properties may also be of use quite apart from mere disinfection. Dr. Tanner gives the following note of its use:—"This agent has been recommended for disinfection and deodorising purposes by Wynn Williams, Campbell De Morgan, Nunn, and Richardson. 200 grains are placed in a common chip box and suspended over the patient's bed. . . . If desired, it may be at once sublimed and the vapour diffused by placing it on a heated fire-shovel. In rooms occupied by *small-pox patients, the air may be kept free from smell* by using iodine in this manner—probably the *strongest proof* which could be adduced of the value of this simple and manageable remedy." We must demur to the statement that deodorising power is a strong proof of disinfection. The fumes of acetic acid are doubtless also soon to have another trial, when the present researches as regards its therapeutic value (for arrest of cancer-cell multiplication) are more matured.

In concluding the subject of disinfection, it may be well to draw notice to the esteem that chlorine was held in when it was the only agent of the kind known. Thus Abernethy says of disinfectants:—"They are sometimes useful, very useful indeed, for they make such an abominable stink that the patient is obliged to have the windows opened." It would be difficult now to find any Medical man who would deny the importance of disinfection.

Cholera and diarrhœa may be stated to be either epidemic or endemic. Cholera is perhaps endemic to a small extent in England, but the nature of this endemic cholera probably is essentially distinct from that of the epidemic type, for there is no evidence that endemic cholera becomes epidemic in England or temperate climates. As regards diarrhœa, Dr. Sansom draws the line sharply between the two parallel kinds of diarrhœa, and shows that rationally they require different treatment. We believe that the members of the

Cholera Congress came to the conclusion that cholera might be produced by the poison of choleraic diarrhœa. Probably the proximate or determining causes of endemic disease become the *predisposing causes* of epidemic disease.

In speaking of typhoid fever, Dr. S. Gibbon remarks—It is caused by the emanations from sewers and from heaps of decaying animal and vegetable refuse. . . . *It resembles* the cattle plague in its pathological character, but some physicians whose opinions are entitled to respect argue that sewers, drains, and dung-heaps do not *per se generate it*, but they must first receive the specific poison from the excrements of patients suffering from the disorder before they can distribute the poison to others. Whichever be the correct opinion, it can make but little difference as to the measures we ought to adopt to prevent it. We can reconcile the two views by looking upon the disease as endemic in the one case, epidemic in the other, the *same cause* being in the former case determining, in the latter predisposing. The successful treatment of the cattle plague has shown that it is not endemic, and the pathological resemblance of it to typhoid fever adds force to these remarks, since it cannot be so stamped out, being endemic. We have the best authorities in favour of sewage being a determining cause of typhoid; just as overcrowding is generally supposed to be the determining cause of typhus, but in some epidemics perhaps generated endemically (as in the case of fevers in temperate climates), so the causes before determining then act also as predisposing causes. If this be so, such causes become doubly dangerous at such times, and so the danger is more easily detected. Thus the cattle plague, without doubt, is not endemic in England, but it is both endemic and epidemic elsewhere, and the cause which predisposes in England may be determining elsewhere. In this respect cholera (Asiatic) resembles the cattle plague; the filth in India causes an epidemic which is predisposed to by filth in England. Dr. Jenner thus illustrates this shifting of cause from predisposing to determining or exciting:—A traveller fatigued and hungry crosses a marsh where miasmata abound. If he is attacked with ague at the beginning of the marsh, fatigue and hunger are the predisposing causes; if after crossing he becomes fatigued and hungry, these causes, before predisposing, become exciting. The constancy of action of such predisposing causes may be appreciated by the following:—"It is also an interesting feature connected with cholera that a second epidemic will sometimes commence in the same house where the first began, even in the same room. Thus in Toeplitz the cholera broke out in the same house near a canal two years in succession. In Edinburgh one of the first two cases, which occurred in 1848, was in the same house where the malady had first appeared in 1832; while in Leith in 1832 and 1848 the disease commenced in the same room. The epidemic in Rheims of 1849 and 1854 also originated in the same house."—Burrall.

The question that suggests itself is—Can we trace these predisposing causes often, and accurately define them? Not altogether; but we know that there are many predisposing causes to disease in general, and also many that predispose to a class of diseases specially.

Elements of Chemistry. Part III. Third Edition. By Wm. Allen Miller, M.D., V.P.R.S. London: Longman, Green, Reader, and Dyer. 1867.

In this edition of the well-known Elements, Dr. Miller follows the notation that he adopted in vol. ii. of the same edition, with the nomenclature of Berzelius. He observes that "the change in notation will doubtless be attended with more inconvenience, though it is certain to be adopted, since in none of the recent investigations made in this country, and in very few of those on the Continent, is the old method made use of." As regards the nomenclature of chemistry, which is at present open to serious charges of inconsistency, it certainly is better to speak of ferrous and ferric in the same sense that we speak of nitrous and nitric oxide. It is feared by the author that such change may appear pedantic and strange, in the face of such terms of modern chemists as stibiotetramethylium. The nomenclature of the alkaloids also requires some amendment; thus we have conylia and nicotylia side by side with sparteia, and cinchonia is isomeric, not with cinchonidia, but with cinchonidine. Of course these are only trifles, but it is highly desirable that one and the same body should not have three names, as conia, coniine, and conylia, especially when terms such as benzol (benzine), benzile, and benzoyl mean such very different things. A reform in this direction is highly desirable, and any simple plan of uniform nomenclature would soon be accepted by all.

The great advantage of this book over others of the same class is that all that concerns the manufacturer and physiologist is explained by chemical theories, and so the field of the chemist is extended as it should be, and made a centre among the allied sciences. Part I. treats of this connexion with the physical sciences; Part II. with geology and mineralogy; while in Part III. economic, physiological, and botanical questions are connected with chemistry. It is obviously a gain for all that an accurate science should connect together others much less so.

We have a good account of the nutrition of animals and vegetables; pus and excretions generally; the saliva, gastric fluid, &c.; muscular tissue; components of brain and nerves, hairs, feathers, sponge; preparation of the various leathers (morocco, wash, and glove); preparation of glue and size; preparation of snuff; manufacture of soap, wine, malt, &c. The book can therefore be recommended to a very large class of readers.

But while chemistry thus enlarges its borders, it should also secure its former possessions, and make them more compact. Thus many substances formerly organic are now undoubtedly inorganic. Hydrocyanic and formic acids can be made synthetically almost as easily as the complicated inorganic ones; and this process of transference from the one kingdom to the other, results in gain for both, since the unity of all chemistry is shown with the gradual transition that always exists in nature. This has been shown so clearly in some other English text-books (especially those of Williamson and Odling) that the success of this scheme of arrangement of general matter requires general recognition. Another matter in the order of treatment of subjects is highly advantageous to the reader—*i.e.*, the consideration of the constitution of sugars and fermentation before speaking of alcohol. This is not usual; but the error of talking about things before unmentioned is avoided. Of course by this method the other advantage is lost—*i.e.*, of discussing alkaloids and organic bases of doubtful theoretical constitution immediately after the sugars—the transition being followed through the glucosides from bodies of known to those of unknown atomicity. We would direct special attention to the subject of fermentation, which is very fully treated, and is of such great interest at present. Dr. Miller's book holds a position of its own in the English language, and it is very difficult indeed to say by what book we could replace the present edition. It will be a very capital Christmas present for all who take an interest in chemical science.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Dingler's Polytechnisches Journal. November.

"*Experiments on the Heat of Fusion, and on the Tem-*

perature of Glass and other Furnaces;" "*On Siemen's Regenerative Gas Furnaces,*" by C. Schinz.—"*On Dyeing Wool with Aqueous Solutions of Aniline Blue,*" by Lachmann and Breuniger.—"*On the Estimation of the Relative Efficiency of Beetroot Presses from the Quantity of Sugar contained in the Expressed Juice,*" by C. Stammer.—"*On the Relative Cost of Manufacturing Ice by Carré's and Siebe's Apparatus,*" by Wegler.—"*On the Preparation of Chrome Green,*" by E. Dieterich.—"*On the Preparation of Pure Cyanide of Potassium,*" by L. Knapfl.

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften zu Wien (Mathematical and Natural History Section). Vol. 53, div. 1. No. 1. June.

"*On the Rose-coloured Semi-crystalline Limestone of the Island of Tiree in the Hebrides,*" by A. Boué.—"*A Microscopical Examination of Human Milk,*" by E. Schwarz.

Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt. No. 1.

"*Contributions to the Knowledge of the Trachytes and Metalliferous Deposits of Nagyag, Transylvania,*" by H. Höfer.—"*On the Chemical Composition of the Vienna Tile Earth,*" by E. von Sommaruga.—"*Analysis of Volcanic Rocks from the Island of St. Paul, collected during the* Novara *Expedition,*" by K. von Hauer.—"*Analysis of Sterro-metal, an Alloy of Copper, Zinc, and Iron;*" "*Analysis of Tertiary Lignite from Lettowitz in Moravia;*" "*Analysis of Lignite from Gamlitz, Steiermark,*" by E. von Sommaruga.—"*On the Purification of Graphite,*" by Schöffel.

Bulletin de la Société Industrielle de Mulhouse. Vol. 36. October.

"*On the Comparative Solidity of Thickeners composed of Lucine and Albumen,*" by T. Roberts and A. Rosenstiehl.—"*Report on the above Paper,*" by G. Schaeffer. "*On the Preparation of Baryta,*" by Rivière.—"*Report on a Memoir on the Manufacture of Caustic Baryta,*" by A. Scheurer-Kestner.—"*On J. Heilmann's Experiments on Water as a Lubricant,*" by Gerber-Keller.—"*On Lecture Diagrams printed on Calico,*" by C. Thierry-Mieg.

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2955. G. F. Freeman, Broughton, near Manchester, "A new composition applicable to rollers for calico printing and to other purposes."—Petition recorded November 12, 1866.

3055. C. J. Wahab, Valleyfield, N.B., "Improvements in purifying polluted water."—November 21, 1866.

3091. C. D. J. Seitz, Sunderland, "An improvement connected with the bleaching of fibrous substances and with the manufacture of bleaching powder, bleach liquor, or sulphuric acid."

3097. J. K. Leather, St. Helen's, Lancashire, "Improvements in the manufacture of salts of soda and potash."—November 24, 1866.

3111. T. J. Barron, New York, U.S.A., "A new and improved method or process for converting iron into steel by the action of certain gases, and for producing gases for such purposes."—November 26, 1866.

3133. W. R. Lake, Southampton Buildings, Chancery Lane, "Improvements in the manufacture of white lead." A communication from W. Bell, T. M. Fell, and A. G. Fell, New York, U.S.A.—November 26, 1866.

3146. E. T. Hughes, Chancery Lane, "A new or improved mode of saccharatification of sugary substances." A communication from Dr. F. Jünemann, Rudolpheim, Austria, and P. du Rieux and E. Roettger, Lille, France. —November 30, 1866.

3180. H. A. Bonneville, Rue du Mont Thabor, Paris, "Improvements in the manufacture of white lead, and in the vessels connected therewith." A communication from J. H. Hebert, Brooklyn, New York, U.S.A.—December 4, 1866.

3212. P. E. de Wissocq, Rue Richepanse, and Count L. Krasinski, Rue de Penthièvre, Paris, "Improvements in the treatment of ores of metals, of which the sulphates are soluble in water."

3214. J. Williamson, South Shields, "Improvements in the manufacture of alkalies."—December 6, 1866.

3226. A. C. Fraser, Colchester, Essex, "Improvements in apparatus used in the manufacture of gas."—Dec. 7, 1866.

Notices to Proceed.

2043. P. Spence, Newton Heath, Lancashire, "Improvements in the production of sal ammoniac in a commercial form."—Petition recorded August 8, 1866.

2083. J. A. Wanklyn, London, and A. Paraf, Manchester, "Improvements in the production of green colouring matters for dyeing and printing textile fabrics and yarns."—August 14, 1866.

2095. J. Webster, Birmingham, "Improvements in coating and recovering metals from chlorides and other solutions of metals."

2101. J. Cameron, Barrow-in-Furness, "Improvements in the manufacture of iron and steel."—August 15, 1866.

2110. G. Payne, Battersea, Surrey, "Improvements in treating fatty and oily matters.—August 16, 1866.

2115. A. Paraf, Manchester, "Improvements in the use and application of an inorganic glyceric ether."—Aug. 17, 1866.

3014. A. E. Blavier, Angers, France, "A process of conservation of cereals and substances alimentary, vegetable and animal."—November 17, 1866.

CORRESPONDENCE.

Test for the Purity of Glue.

To the Editor of the Chemical News.

Sir,—As I am compelled in my business to use a considerable quantity of glue, and being at a loss for a good test to ascertain the comparative value of the various qualities submitted to me, I would feel obliged by your informing me of the best method for doing so. I am, &c.

J. S.

Glasgow.

Deflection of a Galvanometer by a Ray of Light.

To the Editor of the Chemical News.

Sir,—Your correspondent "Phototype" will find a short description of the experiment in which a galvanometer needle is deflected by a ray of light falling on a silver plate, at page 153 of "Grove's Correlation of Physical Forces," fourth edition. I am, &c.

J. Noble.

Woolwich, December 13, 1866.

Mercuric Oxalate.

To the Editor of the Chemical News.

Sir,—Having prepared some mercuric oxalate with the object of studying its properties, I found it to be explosive when rubbed in a mortar, evolving, at the same time, a poisonous vapour, which irritates the throat and occasions coughing. By the action of heat it produces a slight crackling noise, and deposits metallic mercury.

I have not had time to study the reaction which takes place when this substance is heated, but I think it probable that it becomes decomposed into mercury and carbonic anhydride, thus—

$$\left.\begin{matrix} C_2O_2'' \\ Hg'' \end{matrix}\right\} O_2 = Hg + 2CO_2.$$

I am not aware that this property with which mercuric oxalate is endowed is generally known.

I am, &c.

Joseph Richardson, jun., F.C.S.

16, Dawson Street, Manchester, January 1, 1867.

Recovery of Spent Manganese.

To the Editor of the Chemical News.

Sir,—I take the liberty of inquiring if any readers of the Chemical News could inform me whether there have ever been any proposals for recovering binoxide of manganese from still liquor by means of carbonate of lime, other than Dunlop's patent; and if so, who, and where to find particulars? An answer will greatly oblige.

I am, &c. MnO_2.

Determination of Phosphates.

To the Editor of the Chemical News.

Sir,—Can you not do something to rescue chemical science from the not very creditable position occupied in connexion with what is called commercial analysis? "High" and "low" analysts of phosphates ought not to exist. After several years' experience as a manufacturer, I know well that to buy by analyst A. and sell by analyst B. is often a losing game. To buy by analyst B., and to get my products analysed by him before sending them out, and to let my customers send a specimen to analyst A., is always safe; but should they send to analyst C. I am very likely to get a complaint that my superphosphate is "not up to the mark." In practice, when samples of superphosphate which contain the highest percentage—say 35 to 38 per cent. of soluble phosphate and 2 or 3 of insoluble—are analysed by two different men—a "high" and a "low" analyst—we get similar reports; but with about 25 per cent. soluble, the difference is constant—viz., 2 to $2\frac{1}{2}$ per cent. If you, Mr. Editor, were inclined to ventilate this matter, we should, perhaps, ultimately get a "broad" view of the question, quite as correct as either the "high" or the "low" creed. I am, &c.

Smatterer.

Alloys of Magnesium.

To the Editor of the Chemical News.

Sir,—In your report of the proceedings of the Chemical Society, December 6, I observe some misapprehensions on the subject of alloys of magnesium.

1st. It is stated that I brought magnesium wire into contact with the primary metals, &c. It was not magnesium wire that I used, but pure cylindrical bars of magnesium in most cases, and magnesium filings, freshly filed from cylindrical bars, in other cases.

nd. Your readers, from the report in question, might conclude that I stated that the zinc alloy was an exception to the rule of the brittleness and the readily tarnishing properties of magnesium alloys; but, although the zinc alloy seems to be an exception to the easily tarnishing character, and may be kept exposed a long time to the air without tarnishing, it is not, however, an exception to the brittle character of magnesium alloys, as it is exceedingly brittle. Some of the zinc alloy has remained free from tarnish more than six months.

3rd. The silicide of magnesium which is formed together with some oxide of magnesium, when finely powdered silica is heated to redness with an excess of magnesium filings in a current of dry hydrogen, is only slowly decomposed by water, but when treated with dilute or concentrated HCl it gives violent reaction and copious evolution of the spontaneous inflammable siliciuretted hydrogen.

4th. It is not the magnesium amalgam which I suggested the possibility of a substitute for hydrargyrum cum cretâ, but the oxidised portion of the amalgam, which is formed on exposure to the air—a brownish-black oxide of Hg and oxide of Mg + some water which separates from the excess of mercury. The stability of this oxidised compound of Hg and Mg is yet open for further investigation. Hitherto many objections have been made to the employment of hydrargyrum cum cretâ, and also to the hydrargyrum cum magnesiâ; the latter of which is now seldom, if ever, prescribed as a medicine, from the fact that the mercury is more mechanically mixed than chemically combined by the present mode of preparing these compounds—namely, by triturating Hg with chalk, or Hg with magnesia, in a mortar. But could these compounds be prepared so as to obtain a more uniform and chemically combined oxidised state of the mercury? The probability is that the preparation of more valuable compounds of mercury with chalk, and Hg with Mg, would be added to our British Pharmacopœia than those above referred to. I stated that the preparation of a compound of $Hg_2O + MgO$ by oxidation of the "magnesium amalgam" would be difficult, but that this difficulty may be overcome by experience, which consists in separating the finely divided Hg from the oxidised product, as the great density of the Hg_2O and the light density of MgO cannot be uniformly and well washed and decanted off from the Hg. In my paper I have given an analysis of some of the oxidised product which was separated first by pressure in chamois leather, then rubbed with a stout spatula of tin upon a smooth surface. I am, &c.

J. Parkinson.

December 26, 1866.

[We insert this letter, inasmuch as it contains some further details relating to the magnesium alloys, but we do not hold that it is incorrect to apply the term *wire* to the small rods of magnesium which, as commonly sold, are six inches long and *an eighth of an inch* in diameter. The same dimensions in brass, copper, or silver, would always be called *wire;* and iron "telegraph wire" is considerably thicker. Then, again, the diminutive character of the specimens exhibited by Mr. Parkinson would be inconsistent with the use of substantial *bars* of magnesium. The author's crude suggestions respecting the magnesium amalgams and the employment in medicine of an indefinite oxidised portion formed from it by exposure to the air, appear altogether unworthy of attention until the "further investigation" shall have been made. The paper and the analysis alluded to by the author, in his last paragraph, were not forthcoming at the meeting, and many of his statements were inaudible.—Ed. *C. N.*]

Blasting with Gun-cotton.

To the Editor of the Chemical News.

Sir,—In your impression of the 7th instant, a correspondent, "H.S.P.," asks for information upon the method employed in using gun-cotton for blasting operations. A short time since I made some experiments upon this subject for the purpose of comparing the effect produced by the explosion of gun-cotton with that of gunpowder. The rock I experimented upon was a syenitic granite in the island of Jersey, exceedingly hard, and most difficult to blast. The method I adopted in using the gun-cotton was precisely the same as when gunpowder was used. A boring was made in the usual manner by the repeated blows of sledge-hammers upon a steel-tipped chisel which was turned round a few degrees after each blow. From time to time the powdered rock has to be extracted from the boring. The process is an exceedingly slow one, as it takes three men about six days to bore a hole 15 feet deep and 3 inches in diameter. The required depth having been obtained, the boring is thoroughly

cleaned out by a rod of iron with a roll of tow at its extremity; everything is then ready for introducing the gun-cotton. The gun-cotton I employed was manufactured by Messrs. Prentice; it is made into a kind of rope, of different diameters, and in lengths of about 6 inches; each length is covered with parchment, a hole being left through the centre of the cartridge. In a boring of the depth above mentioned, of course a number of these cartridges have to be used; they are then connected by pieces of patent fuse. In a boring of 15 feet depth, about 6 feet from the surface is tamped in the usual manner with clay, a fuse passing from the uppermost cartridge to the surface. Great care is requisite in tamping. Immediately above the top cartridge a little hay or tow ought to be placed, as accidents have occasionally happened through the charge prematurely exploding, probably by a spark produced by the friction of fragments of rock during the blows given with the tamping-rod. The charge being thus placed, everything is ready for the blast; a light is applied to the extremity of the fuse, and while it is burning down to the gun-cotton, all hands withdraw to some safe retreat, in case of a shower of fragments of rock.

As to the effect produced by gun-cotton in blasting such hard rock as I experimented upon, I am of opinion that, in the form in which I used it, it cannot be compared to gunpowder when large blasts are required. I tried several small blasts, with a single length of the gun-cotton rope, and I found that more rock was moved than when a quantity of gunpowder of an equal value was used; but with larger blasts, in which several lengths of the gun-cotton rope joined together by the fuse were used, the effect produced was not so great as that produced by an equivalent quantity (pecuniarily) of gunpowder. I accounted for this by supposing that the whole length of gun-cotton rope did not explode simultaneously, but that each cartridge exploded at a minute interval after the one immediately above it, and therefore the explosive force was much diminished. There are many advantages in favour of gun-cotton—for instance, it is, bulk for bulk, much stronger than gunpowder, and therefore a great saving in the cost of boring is effected by its use; and in tunnelling or underground blasting, it is invaluable on account of the absence of smoke after the blast. I found that the gun-cotton shattered the rock more than gunpowder—an advantage, perhaps, in mining and excavating operations, but a disadvantage in quarrying where large blocks of stone are required. I am, &c.

T. A. Pooley, B.Sc., F.C.S.

1, Torrington Street, W.C., London, December 18.

MISCELLANEOUS.

Dangerous Toys.—Everybody must have noticed the growing tendency that there has been of late years on the part of manufacturers of almost every description to invest their wares with a spurious scientific value. Such methods of increasing business are not particularly mischievous, and the more sensible portion of the public has ceased to be misled by them, and looks on them merely as tricks of trade. Within the last two or three years, however, it has been discovered that certain dangerous chemical compounds could be transformed into so-called scientific toys, to amuse, burn, and poison the children of the public. The mania began with Pharaoh s-serpents, which, although harmless enough when exhibited in a well-ventilated lecture theatre, emitted mercurial fumes enough, when shown in a small parlour, to salivate those present. A young prince, when they first appeared in Paris, mistook one for a *bon-bon*, swallowed it, and just escaped with his life; the article being covered with tinfoil, in order, no doubt, to make it look as much like a chocolate pastille as possible. The "Devil's-tears" are much more likely to do serious mischief than the Pharaoh's-serpents. They consist of a little cotton-wool oval capsule open at one end, and covered with a thick layer of varnish of some kind to give it solidity. At a small distance, they look precisely like a red sweetmeat, or one of the berries of the hawthorn. Indeed, out of five children who were separately asked to say what they were, three answered that they were sweets, and two said they were berries. Inside the capsule is a little pill of coarse paste made up apparently of potassium and heavy coal oil. When thrown into water, the potassium of course inflames, rushes about the surface in the usual style, and finishes the display by sending several red-hot globules of potassic hydrate into the faces of the admiring spectators. But let any of our readers imagine the fearful results of a child swallowing one of these devil's-tears, which are so like sweetmeats and berries. On the tube containing them there is the *naïve* direction, "Do not put them in the mouth." Now, if there is one thing especially calculated to make a child swallow anything, it is to tell him not to put it in his mouth. Even if these mischievous capsules are not swallowed, the danger of inflicting fearful burns on damp fingers still remains. Of course, the "inventor" of the devil's-tears has had a number of imitators who have gone to work more clumsily, cheaply, and dangerously. The Juno's-tears, witches'-tears, and half-a-dozen other imitations are simply little pieces of sodium done up in corked tubes without any protecting liquid. The directions given, of course, prescribe hot water for the experiment, but nothing is said *apropos* of feeding on the contents of the tubes. The inventor of the devil's-tears is Barnett, the same individual who first introduced the Pharaoh's-serpents. On the label of the bottle there is the following singular announcement:—"Barnett, patentee (complete specification in England, France, Belgium, America, &c)." Does Mr. Barnett really mean to tell us that he has patented the ignition of potassium by throwing it into water? Are we to see this dear old experiment no more at popular lectures? Or is it only to take place by his special permission? Why does he not also patent the combustion of charcoal, iron-wire, sulphur, and phosphorus in oxygen? As yet, we fancy, the sale of these dangerous toys has not been very great; Christmas, however, has now arrived, with its holidays, parties, and increased pocket-money. Hundreds of these potassium pellets will be purchased, and these little red balls, hardly distinguishable from sweets and berries, will be rolling about half the nursery floors in the kingdom. Have the police no power to stop the sale of such articles? A tainted leg of mutton is liable to be seized and the butcher fined, a poor errand-boy who lets off a squib in the street is handed over to the police, and yet "devil's-tears" are sold with impunity.

Use of Sodium in Metallurgy of Silver.—Mr. Kustel's opinion, that sodium is "too expensive" to be applicable, is untenable in the extreme. As a *reductio ad absurdum*, let us suppose that it were necessary, as he believes, in the translation to amalgam of the silver in an ore (the chloride, for instance) to use an equivalent quantity of sodium; then, as 1 lb. avoirdupois of sodium is equivalent to 4·7 lbs. of silver, or about 75 oz., worth at $1·29 per oz. $96·75, it is necessary to show cause why the cost of sodium must approach this latter sum (in coin) per lb., to prove its use even for "decomposing" chloride of silver unprofitable, and to give any currency to this "idea" of Mr. Kustel's.—*Henry Wurtz.*

Action of Sodium Amalgam on Silver Ores.—I recommend practical metallurgists (all, of course, familiar with the tardy and tedious action of iron on moist chloride of silver) to bray together in a mortar some iron filings, quicksilver, and precipitated chloride of silver, adding, meanwhile, a small quantity of sodium amalgam, the sodium in which, however, may be but a small fraction of that equivalent to the chloride. The almost instanta-

neous result will be a mass of pasty or nearly solid silver amalgam. If such phenomena as this are to be ignored, or pooh-poohed, as signifying nothing, and having no bearing on the working of silver ores, I have but to submit respectfully that this seems like carrying an assumption of practicality (?), and an affectation of contempt for science considerably beyond the limits of common sense.—*Henry Wurtz.*

Sodium Amalgamation in Colorado.—Letters have been received from Mr. Bruce, who is one of the oldest and most reliable of the Colorado mill men. In one he says, after relating the above result in his battery—"I am putting into the mill one of the Bertola pans, and will have it running this week. I expect big results from the amalgam with the pan. I think every mill in the mountains would use the amalgam if anybody had it to sell." Later, under date July 17, Bruce says—"Everybody believes the amalgam to be the best thing yet, and everybody would buy it were it for sale here. You can rest assured the amalgam is all right. Last week I used ¼ oz. of amalgam to 2 lbs. of quick (quicksilver), and I think ½ oz. to 2lbs. is better than 8 oz. to 2 lbs. quick." Under a still later date, July 30, he says—"The amalgam is doing nicely for me. The longer I run the mill with it, the better I like it. The ore is what we call white quartz, with some copper and white iron pyrites. The Black Hawk Company like the amalgam very much, and will use it all the time. Col. Grafflin has some to try on his ore soon. I will send reports from him as soon as I can get them. Every one thinks well of the amalgam who has had it to use, with two or three exceptions, and I think they did not care to use it."—*Henry Wurtz.*

Preparation of Chromate of Copper,* by M. Stinde.—Under the name of chromate of copper a green liquid is sold, consisting of a solution of neutral chromate of copper in ammonia. It is much used in dyeing, and is prepared by the following method:—Dissolve

Bichromate of potash	1 p.
In hot water	20
And add sulphate of copper	2

keeping the temperature near the boiling-point, and supplying the place of the evaporated water by fresh hot water. When all is dissolved, add gradually a solution prepared with

Crystallised carbonate of soda . . .	1 p.
Boiling water	2

Redissolve the first-formed precipitate by shaking, and at the same time carbonic acid will be disengaged; when no more of the latter is evolved, stop the shaking; a brown precipitate will have been formed, consisting of chromate of copper, which allow to deposit, and decant. Wash the precipitate three times in warm water so as to remove the sulphate of potash, then with cold water; afterwards dry, and add ammonia of 0·91 of density. Any excess of ammonia must be avoided, and it should be aded in small quantities at a time, as the precipitate is very soluble. Filter quickly through flannel, reduce by evaporation to 25° B., and preserve in closed vessels.

On a Mineral of Yttria in the Alps,† by M. Wartha.—Under the name of wiserine, an yttriferous mineral has been described, which has been found in the Haut-Valaise, as well as on Mont Fibia, south-west of the Hospital of Saint-Gothard. It crystallises in square-based prisms similar to zircon. It was supposed to contain silica and titanic acid, but M. Wartha has found this to be an error, and that, excepting a little iron, it contains only phosphoric acid and yttria. It is a phosphate of yttria, identical with the xenotime of Berzelius, and it is of particular interest on account of its Alpine origin, as yttria has hitherto been vainly looked for among the various Swiss minerals.

* *Polyt. Journ.* clxxx. 480.
† *Ann. Chem. Pharm.*, cxxxix. 239.

Meetings for the Week.

Tuesday, January 8, 1867.
Royal Institution, 3 p.m. Professor Frankland, "*On the Chemistry of Gases.*" (Juvenile Lectures.)
Royal Medical and Chirurgical, 8½ p.m.
Photographic Society, 8 p.m.
Ethnological Society, 8 p.m.
Wednesday, January 9.
Microscopical Society, 8 p.m.
Thursday, January 10.
Royal Society, 8½ p.m.
Friday, January 11.
Astronomical Society, 8 p.m.

ANSWERS TO CORRESPONDENTS.

NOTICE.

We have great pleasure in announcing that the Abbé Moigno has undertaken to forward each week a letter containing the scientific news of the Continent, the first of which will appear in our next.

The present volume of the Chemical News *will contain an illustrated series of papers on the Application of the Blowpipe to Quantitative Analysis and Assaying, by David Forbes, F.R.S. Papers on the Synthesis of Organic Substances, and their Application to Manufactures, by Dr. F. Crace Calvert, F.R.S. Also, a full account of Professor Stas's recent Memoir on Atomic Weights, with a detailed description of the processes employed. An entirely new and complete set of Tables for Qualitative Analysis, by Dr. Hofmann, F.R.S., and some articles on Cyanogen, by Dr. Odling, F.R.S., are also in preparation, and will appear as soon as ready.*

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. 6d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commences to-day, and will be complete in 26 numbers.

C. H. H.—"Estimating Nitrogen by Chloride of Zinc," by James Walker, is contained in vol. ii., No. 51, p. 230.

CsS2 asks whether there is any apparatus at present in use for the extraction of grease by bisulphide of carbon, and, if so, who are the makers of such apparatus.

Obtaining Steatite.—*J. C.* wishes to know where he can obtain a few tons of good steatite, and at what price.

Utilisation of Gas Liquor.—A correspondent who has the management of a small gas works in a village, and does not know the value of the ammoniacal water, will feel greatly obliged if any one will inform him of the best plan of utilising it.

Sydney Heely.—A full description of the construction and powers of Wilde's magneto-electric machine, written by Mr. Crookes, will be found in the October number of the *Quarterly Journal of Science*, published by Churchill.

J. A. asks if any one can inform him of the exact quantity of tar or crude oil which manufacturers in this country obtain from one ton of Boghead gas coal, and of the quantities of paraffin and other oily products they obtain from 100 gallons of crude oil. Probably some of our correspondents may be able to furnish the information; if so, we shall feel obliged.

Engineer.—The unpleasant smell is not the only objection to the use of coal or coke containing sulphur. It has been found that when such fuel is burnt under steam boilers the iron is rapidly corroded by the sulphur.

"*Fire-damp.*"—Mr. Ansell has written to say that each and every statement made in the paragraph in the *Mining Journal* is simply untrue. A full account of the "Indicator," written by Mr. Ansell, will be found in the Chemical News, Vol. XII. p. 280.

Received.—Dr. Letheby: B. W. G.

Books Received.—"Braithwaite's Retrospect," 1866; "Dictionary of Chemistry," Part XXXVII., Silica—Sodium.

THE SUSPENSION OF THE STORM SIGNALS.

The use of storm warnings at various stations on the coast for the purpose of enabling seamen to prepare for the approach of bad weather was, as is well known, originated by the late Admiral Fitzroy, and by him was brought to a high state of practical efficiency. Since his death the system has been continued under the direction of Mr. Babington; and it is a sufficient proof of the ability with which this undoubtedly difficult subject has been managed, that, so far as is known, no complaints have been made by any of those most interested in its operation.

The opinion of the value of these signals that was so generally entertained makes their sudden stoppage appear the more extraordinary. The Board of Trade were guided in their decision by the recommendation of the President and Council of the Royal Society, who are of opinion that "at present these warnings are founded upon rules mainly empirical, and therefore should not be issued under the superintendence of the scientific body to whom the discussion of meteorological observations will be committed." Many objections to this view of the subject at once present themselves, without regarding the obvious fact that, before taking so decided a step, the Board of Trade should at least have consulted the wishes and opinions of those chiefly concerned — viz., the fishermen and owners of small coasting vessels, and to whom a knowledge of the probable changes of weather is of paramount importance. It cannot be denied that the rules of this branch of science are at present mainly empirical, but this is an evil which would daily tend to remedy itself; and if on this account the duty of carrying them out were considered to be derogatory to the scientific body entrusted with the management of meteorological observations, this would point, not to the abandonment of the system, but to its being relegated to some more suitable department. As was forcibly urged by Mr. Baxendell, at a recent meeting of the Manchester Literary and Philosophical Society, in the early stage of every science its rules are mainly empirical; but it has never before been stated that therefore we should not avail ourselves of the knowledge we possess. The correction of the compasses in iron ships is based upon somewhat empirical rules, and mistakes are sometimes made, but are we on that account to neglect to take any such precaution? Reasoning of this kind, if logically adhered to, would lead to the entire abandonment of the use of medicine, which, we think, no one would venture to assert is administered according to strictly scientific laws. It is doubtless a misfortune that the rules of meteorology are not at present mathematically accurate, but the surest way of making them so would be to carefully compare the predictions with the phenomena that actually occur, and, by gradually eliminating disturbing causes, to plant the subject upon a firm scientific basis.

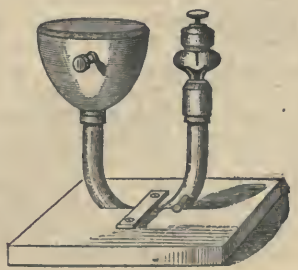
We trust that the disappointment so generally felt at this retrograde movement on the part of the Board of Trade will have the effect of making them reconsider their determination, and that, directing their attention to the good it has done, rather than to its present want of scientific symmetry, they may continue a system which has become familiar to, and met with the approval of, the country, and which seems, more almost than any other undertaking, calculated to advance the science of meteorology.

ANSELL'S FIRE-DAMP INDICATOR FOR COAL MINES.

Recent events have given great interest to the invention of Mr. Ansell, to which attention was called in Vol. XII. p. 280 of the Chemical News. Although those descriptions were at that time perfectly correct, it is hardly to be expected that Mr. Ansell should have left the matter where it then was, especially as he has largely tested those instruments in coal pits in the positions where they would be required for use. They entirely answered the purpose for which they were proposed—namely, the indication of fire-damp, when accumulating either slowly or rapidly; but there were objections which on the face of them were serious, and which by practical men were considered fatal, unless under exceptional circumstances. Guided by the opinions then expressed by those most concerned, Mr. Ansell endeavoured to find a more simple form of instrument, which could be readily understood by a workman of ordinary intelligence.

In coal pits there are many casualties — including the bulk of the accidents arising from explosion— caused by a sudden irruption of fire-damp (carburetted hydrogen) to such an extent as to render the atmosphere in even a mile of space explosive in a few minutes, and there are cases on record where an enormous space has been so polluted in a few seconds; but the common event is to find that a fall of roof, or the breaking in of a thin part in the sides or floor of a gallery, liberates an amount of gas which by mixture with the ordinary air of the pit renders the whole explosive. This mixture travels on slowly with the ventilation, till presently it meets a light, and possibly an hour after its first formation destroys many lives. In all such cases Mr. Ansell proposes to use an instrument of which Fig. 1 is a sketch.

Fig. 1.



It consists of an iron funnel provided with an iron U-tube, the end of which is closed by a piece of glass tube fixed in brass, to which one pole of a battery is attached; the upper part of this glass tube carries a brass collar, through which passes an adjusting screw, to the lower end of which is fastened a piece of copper wire with a platinum point. Mercury is poured into the iron funnel till it rises in the glass tube to a

convenient height. This mercury is allowed to find its level by the opening of a valve, when setting the instrument.

The septum is a tile of Wedgwood's ware, and closes the open part of the funnel, good sealing wax being the best cement for securing it in its place. The other battery wire is connected with the instrument, so that, if diffusion take place, the mercury is pressed up against the platinum point, and thus communication is established. Mr. Ansell has found that this instrument gives warning in four seconds if the mixture of gas be still below the point of explosion; but, by adjusting the point so that there is not more than the thickness of a shilling between it and the mercury, a dangerous irruption may make itself known in two seconds.

A source of great danger is that state of the pit which arises from the gradual bleeding of gas from the coal. As one walks in a pit one hears a continual click, somewhat like the noise of a cricket. In some pits this may arise from the settling down of the shale and cracking of the coal, but the experienced ear soon knows the difference. Should any obstruction arise to the ventilation, this bleeding very gradually raises the atmosphere from zero (the point of purity) to the point of explosion; or it may be that a gradual fall of the barometer admits of the oozing out of gas either from a goaf or from the mass of coal, and this, although very minute, may be to such an extent as to render explosive the whole air of the pit, if the ventilation be not very good. There are parts of the pit where gas may so accumulate in half an hour; others where it may be two hours, and again others a whole day, in rising to a dangerous mixture. To meet such cases, Mr. Ansell used, in the first instance, an india-rubber balloon; but this, although perfectly good for its purpose, was too fragile. Therefore, he has abandoned that plan, and he now uses white Sicilian marble, and by regulating the thickness avoids the evil of effusion to such an extent that he can, and does, in the pit practically show these gradual accumulations. Mr. Ansell has found that by replacing the Wedgwood ware tile (in Fig. 1) with marble of a quarter of an inch thick, he can show the presence of an explosive mixture of fire-damp and air which has been half an hour in forming, or by using marble half an inch thick he shows if it has been two hours rising from zero to the explosive point. In all such cases, notice, if it be so desired, may be given before the mixture becomes explosive, the warning being continued for a considerable time even if the atmosphere does not become more foul. It must, however, be understood that the very circumstances which admit of the air becoming "fouled" to the extent of 10 per cent. also admit of its going on till 50 or more per cent. has been reached, always remembering that these instruments are to be fixed high up in the roadway or goaf, and that the gas accumulates there notwithstanding the law of diffusion. It is no uncommon thing to find 30 per cent. of gas next the roof, at six inches lower 20 per cent., and at fifteen inches no gas at all. The cause of this will be discussed on some other occasion.

It is proposed to fix the instruments side by side, one for *sudden* and the other for *slow* accumulations, in pigeon-holes cast in the iron props used to support the roof, these pigeon-holes being clear all through so that the gas can surround the instruments or sweep over them; for the gas as it occurs in the pit is very curious in its habits, and, from causes too minute to enumerate here, it "goes away" from a spot with very little "disturbance." The pigeon-holes being formed in iron posts would protect the instruments from falling roof, &c., while grooves may be cast in the sides of these posts for the telegraphic wires. It has been objected by some that these instruments would cause greater destruction of life than now obtains; but these persons forget that they are not intended to displace other means of safeguard. They are simply proposed as additional means of knowledge.

For the indication of carbonic acid Mr. Ansell makes a necessary alteration, which will be seen in Fig. 2.

Fig. 2.

This hardly needs description, for it will be seen at a glance that the circuit is completed by the rising of the mercury to the wire within the precincts of the closed chamber formed by the neck of the funnel, and is adjusted for use by turning the base on which it stands, when a cork rises against a leather bag, and presses the mercury up to the required height. Whether marble will stand long without disintegration by carbonic acid has to be determined; if not, it can be replaced by another septum. This instrument is proposed for use in those mines where carbonic acid becomes a dangerous substance for the miner. It has been sought by the French wine-growers as a means of telling the time of the commencement of fermentation, and it seems probable that the English brewers will use it for a similar purpose.

In the event of fire-damp being known to exist, either when found by the fixed indicators or by the safety lamps, Mr. Ansell proposes for the use of the miner, the manager, or his deputy, an aneroid indicator, described in detail at page 280, Vol. XII., of the Chemical News. Some persons who have not cared to read the description, or to make themselves acquainted with the use for which this instrument is made, imagine that it possesses strange properties. It is therefore necessary to say that it is not used for the detection of gas in the pit. The intention of this particular instrument is that it shall be used to determine the amount per cent. of fire-damp or carbonic acid gas where they are known or suspected to exist; and for these purposes it must be used rigidly according to the instructions given with it, not according to the fancy of the user *or as he thinks it should be used.* It must be taken, with its brass cap still on, into the neighbourhood of the suspected atmosphere, and allowed to remain there till it has acquired the temperature of that place; this usually requires a few minutes (say five). The valve must then be opened to allow it to find the true zero of that altitude. Then the valve must be closed, and the index watched for a few seconds to see if it be stationary, and if it be so then the brass cap must be removed, and the indicator held by its handle in the suspected place for the time specified on the instrument—about one minute.

It must be mentioned that the same amount per cent. of fire-damp in different mines requires a varying time for diffusion through the same tile. The cause of this is at present unknown, but it is under investigation. This variation of time is from 45 to 60 seconds, but in the same pit it is invariably of a uniform time, so that once determined there is no trouble. That this is a property of the gas is proved by the fact that 10 per cent. of gas in one pit will explode violently while 10 per cent. in another pit explodes with much less violence. The underviewers call one a *sharp* gas and the other a *slow* gas or fire, and the difference is perfectly well marked if observed for a few times in the lamp.

A mine, to be well ventilated, should be so supplied with air that a considerable irruption should be diluted below the point of explosion. Ventilation which is only sufficient for ordinary occasions must be considered entirely insufficient.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Nature of the Gas which is given off from Fresh Charcoal when immersed in Water, by William Skey, *Analyst to the Geological Survey, New Zealand.*

As far as I can learn, it is generally supposed that the gas escaping from charcoal when put in contact with water is common air, and, indeed, I am not aware that any different opinions are, or ever have been, entertained. I therefore beg to state the results of certain investigations of mine upon this gas, which show it to have a different composition from that assigned to it.

I shall begin by stating that I was led to these investigations by observing, in the course of some experiments in connexion with the absorption of charcoal, that as large a volume of gas was given off from recently ignited charcoal, when means had been taken to exclude the presence of air during the cooling down of the red-hot charcoal to ordinary temperatures, as where it had been suffered to cool in contact with air. Thus, when a piece of red-hot charcoal was plunged into mercury, and, after cooling, suffered to rise directly into water subsequently put upon the mercury, as large a volume of gas is evolved as if it had been cooled in air.

From this circumstance it appeared to be in the highest degree improbable that any oxygen should enter into the composition of this gas, the affinities of charcoal at high temperatures for oxygen being so great as to render it impossible that it could be held so loosely, by an act, as it were, of mechanical absorption, as to be capable of being displaced by water.

Nor is the quantity of gas given off in this manner by charcoal to water so small that it can be accounted for by taking into consideration the effects of mechanical absorption upon the highly rarefied air left intact as a residue in the pores of the charcoal by its sudden refrigeration. Thus the quantity of gas given off by one volume of the charcoal of the manuka and pine was found to be no less than three and a half volumes.

These considerations suggested an attempt to discover—

1st. The nature of the gas.

2nd. The circumstances to which this capacity of charcoal to evolve gas is related.

Respecting the nature of the gas, it was found to be insoluble in water—at least to any very appreciable extent. Mixed with air, it is uninflammable; while its volume does not appear to be the least diminished by prolonged contact with hydrate of potash or with a solution of potassio-tartrate of protoxide of iron; the green colour of the solution, of course, remaining unchanged. Its specific gravity was found to be ·99, after making the proper deduction for the amount of aqueous vapour it would have retained by contact with the water employed to liberate it at the temperature it sustained.

From these facts it would appear the gas under consideration is nitrogen. I am aware the specific gravity is a little too high, but the excess is quite within the limits of error. I should be prepared to allow for the use of the clumsy and ill-adapted apparatus I had to employ for the purpose.

In prosecuting the second part of the inquiry, it was found that this property of recently ignited charcoal remained to it, no matter how frequently it was ignited and immersed in water.

Nor is a full ignition absolutely necessary to secure this property to charcoal; for if, after an immersion in water for forty-eight hours (by which time the evolution of gas has well ceased), it is subjected to a temperature just under that at which luminosity commences, then cooled under mercury, and suffered to rise into water, as large a volume of gas is evolved as before. Moreover, the application of a white heat appears to confer this property upon charcoal to the same degree as a red heat.

It was next ascertained that, by igniting charcoal, that had been previously in contact with water, in common salt, there was not the least evolution of gas on treating the fused mass with water.

The behaviour of recently ignited charcoal with different liquids was next observed, when it was found that, if it was suffered to rise into kerosene oil or oil of turpentine after being cooled under mercury, there was not the least evolution of gas, nor yet if, for the oil, concentrated sulphuric acid or saturated solution of caustic potash or chloride of calcium was substituted; but the liberation of gas was instantly determined by a subsequent treatment with water. But in concentrated solution of ammonia, carbonate of ammonia, nitric acid, alcohol, ether, or bisulphide of carbon, the yield of gas appeared to be quite as great as in water.

Red-hot charcoal plunged into kerosene oil, bisulphide of carbon, or concentrated sulphuric acid, and afterwards immersed in water, was incapable of affording gas.

(To be continued.)

TECHNICAL CHEMISTRY.

The Magnetic Polarity of Rifles, by John Spiller, *F.C.S.*

Having recently made an observation in this direction which may prove interesting to some of your readers, I am desirous of knowing from others the results of firing under different circumstances from those in which we are placed.

I find that all the long Enfield barrels of the arms in the possession of the volunteers of my company exhibit magnetic polarity, as the result of the violent and repeated concussions attending their discharge in a direction parallel to the magnetic meridian. The Royal Arsenal range runs nearly north and south, and our rifles when in use are always pointed either due north, or a few degrees towards the west—in fact, nearly in the direction indicated by a compass needle,—so that the repeated shocks brought about by the explosion of the powder may be considered equivalent to so many hard blows from a hammer, which are known to have a

similar effect. The magnetic character appears to be permanent, which would not be the case if the gun-barrels were of the softest description of malleable iron, and the region of the breech is in every instance possessed of north polarity, since it strongly attracts the south pole of the compass needle. These effects should not be noticed at all, or only to an inferior degree, in arms ordinarily fired in directions east and west; and I imagine that by reversing our usual practice, if it were possible, and firing towards the south, the indications of polarity would be changed.

The great masses of wrought iron entering into the construction of the heavy rifled ordnance do not, so far as my observations have extended, exhibit like results, although fired for proof at the selfsame range; neither do the old cast-iron guns. I am well aware that it is scarcely possible to find rods of hard iron or steel destitute of magnetic polarity, but the indications to which I now allude are so well marked, and are, moreover, coincident; they must therefore be the result of the operation of a general law.

The foregoing observation seems to me to have a parallel in the remarkable instance of the polarity of Her Majesty's ironclad *Northumberland*, built last year at Millwall. This vessel was placed due north and south during her construction, and the repeated vibrations to which she was subject whilst in that position induced a condition of polarity which demanded a subsequent operation for the purpose of demagnetising her. No such practical inconvenience arose in the case of the iron steamship *Great Eastern*, which was built in the same yard, but in a position at right angles to the former, or nearly due east and west.

Chemical Department, Woolwich, Jan. 7.

FOREIGN SCIENCE.

(From our own Correspondent.)*

Paris, January 8, 1867.

The Imperial Commission has conceded in the interior of the Champ de Mars—that is to say, on the grounds of the Exhibition—an eligible spot of ground, situated at the side of the International Club, with the exclusive privilege of giving lectures day or night. The entire edifice is to cost 2000*l.*, and is to be erected before April 1. The amphitheatre fitted with seats in steps will accommodate 500 seated auditors. We will not publish to-day the very varied syllabus of this course of lectures, but content ourselves with stating that it is of a nature to satisfy amply governments and exhibitors, and that the celebrities of science and national and foreign industry will certainly take part therein. We may also add that those whose exhibits are the largest or most novel can put down their names for one or more lectures, so as to bring the merits of their inventions or produce more into notice. Along with Messrs. Pierre Petit, concessionist of photography to the Commission, and Ducoin, we shall take a very active part in this fine enterprise, which will add, we hope, to the interest and *éclat* of this great struggle among nations, united in a sentiment of a generous rivalry of peace and conciliation.

M. Berthelot terminates, in the last number of the *Annales de Chimie et de Physique*, a long series of papers upon hydrocarbons, with the following considerations, which we hasten to place before our readers:—"The carburets, petroleums, and bitumens, which are often disengaged in great abundance from the crust of the earth in a continual stream, and arise from depths which seem to exceed those of stratified formations—do these combustibles, I say, always necessarily result from the decomposition of a pre-existing organic substance? Is this the case with the carburets so often observed in eruptions and volcanic emanations, and to which M. Ch. Saint-Claire Deville has called attention during these last years? Lastly, should a similar origin be assigned to the carbonaceous matters and carburetted hydrogen contained in certain meteorites, and which appear to have had an origin foreign to our planet? These are questions upon which the opinions of several distinguished geologists are not yet fixed. Without pretending to decide a question which requires the assistance of observations foreign to chemical synthesis, it appears to me to be interesting to show how natural hydrocarbons could have been formed synthetically—I mean by purely mineral reactions, similar to those which geologists make intervene between the substances contained in the interior of the globe and the consecutive materials of its envelope. The hypothesis recently put forth by M. Daubrée, that the terrestrial mass contains free alkaline metals in its interior, joined to the experiments which I have made lately, lead almost necessarily to a mode of explaining the formation of hydrocarbons—in fact, the carbonic acid, everywhere infiltrated into the crust of the earth, coming in contact with the alkaline metals, forms acetylides. According to my experiments, these same acetylides would result also from the contact of earthy carbonates with alkaline metals, even below a dull red heat. Now, these alkaline acetylides once formed can be subjected to the action of steam; free acetylen would be the result, if the products were immediately withdrawn from the influence of heat, hydrogen, and other matters present. But, on account of these different conditions, the acetylen would not exist, as my recent experiments prove. In its place we obtain either the products of condensation which approach the bitumens and tars, or the products of the reaction of hydrogen upon the matters already condensed—that is to say, more hydrogenated carbides. For example, the hydrogen reacting upon the acetylen produces ethylen and hydride of ethylen. A new reaction of the hydrogen either upon the polymeres of the acetylen or upon those of the ethylen would engender formenic carbides such as constitute the American petroleums. An almost unlimited diversity in the reaction is here possible, according to the temperature and the bodies present. We can thus conceive the production by a purely mineral method of all the natural hydrocarbons. The intervention of heat, water, and alkaline metals—lastly, the tendency of the carbides to unite together so as to form matters more condensed, suffices to account for the formation of these curious compounds. This formation can also be effected in a continuous manner, since the reactions which produce it are incessantly renewed."

M. Berthelot is truly astonishing. What force of conception, what power of labour, what rapidity of expression! These last memoirs occupy no less than a hundred pages of the December number of the *Annales de Chimie et de Physique*.

The first form given by M. Mille to his petroleum lamp—an external recipient in metal, an internal one in wire-gauze, a sponge occupying the centre of the vase, and steeped in essence of petroleum—has undergone a very simple modification, under the hands of Messrs. Leplay and Noël, 14, Rue Belzance, Paris, which will render the lamp extremely popular. This improvement consists in the addition of a round wick in contact, at one of its extremities, with the sponge wetted with the essence, and touching at its other extremity the end of a tube, through which it passes, and which forms the termination of the exterior metallic reservoir. In order to prepare the lamp,

* It gives us great satisfaction to lay before our readers the first of the promised weekly communications from the Abbé Moigno. The Abbé's opportunities for acquiring early information are very great, and his position in the scientific world is so well known that he requires no further introduction from us.

the cap is removed and the essence poured in; and when the sponge is saturated the excess of liquid is poured out, so that there is no more free essence, and were the lamp upset, none would run out, nor would there be risk of fire. This lamp is very light, and takes up little room. The flame is about equal in intensity to that of a wax or tallow candle. It burns for several hours without sensibly losing its brilliancy, and is most convenient to carry about without soiling one's clothes. To extinguish it, it is sufficient to let down the tube, which is covered with a small cap in order to prevent the liquid from evaporating during the day. The essences which supply these lamps have a density of 700 to 750 (that of water being 1000)—intermediate between the essences of a density of 650 to 700, which give gas by the spontaneous passage of atmospheric air in the cold generators of M. Mille, and the essences of 800 to 820, which is burnt in ordinary petroleum lamps. These little gazo-lamps cost from 2fr. 50c. to 6fr., according to their size and ornamentation. Messrs. Leplay and Noël sell the liquid at 1fr. the litre. If these prices seem a little high, it must be recollected that this is a new patented invention.

The *Journal de Seine-et-Oise* mentioned lately that at the meeting held on the 19th ult. by the Society of Natural Sciences of Seine-et-Oise, M. Martin de Brettes, Commandant and Professor of Artillery, had exhibited a gun on the Flobert system, which his Majesty the Emperor was much pleased with at Compiègne, and of which the cartridge is inflamed by electricity. Two small electric batteries are enclosed in the stock; their conducting wires arrive at the surface of the breech, and can be put in communication with the extremity of a platinum wire which traverses the cartridge. A simple pressure of the finger upon the trigger closes the electric circuit; the current passes; the platinum wire becomes at once redhot, and inflames the powder which surrounds it. The cartridges prepared for the needle gun carry their own priming, and a shock might inflame them; the cases are thus liable to explode and deprive the troops of their ammunition. With the new system this danger is impossible. It can, as the expense is trifling, be easily applied to guns of the ancient model. We extract this from the *Presse des Deux-Mondes*, but it seems to us impossible that our friend, M. Martin de Brettes, could have omitted to say that the honour of this new application is due to M. Trouvé, the ingenious inventor of the electric *bijoux*, to whom we have called his attention. We do not expect that the voltaic pile will become one of the essential adjuncts of carbines, but the inflaming of powder by electricity will be certainly very soon adopted for cannon.

F. Moigno.

PROCEEDINGS OF SOCIETIES.

SOCIETY OF ARTS.

On the Synthesis of Organic Substances, by Dr. F. Crace Calvert, *F.R.S., F.C.S., &c.*

The Council of the Society of Arts having again conferred upon me the honour of delivering a course of lectures on chemistry, I have deemed it advisable to lay before the members of this influential and eminently useful Society a branch of investigation and series of facts different entirely from those which I have examined on two former occasions. My first course had reference principally to the properties, the manufacture, and the application of certain classes of organic substances derived from or relating to the animal kingdom. I tried, at the same time, to impress upon the minds of my hearers the importance of studying chemistry in connexion with those branches of manufactures; and I further attempted to effect this by drawing attention to the recent improvements which chemistry had introduced: and there are, no doubt, many more improvements that science will develope in process of time. My last year's course was conceived with a view of impressing on the minds of those fond of scientific pursuits the necessity of studying chemistry not only as a separate branch of learning, but in its obvious and intimate connexions with nearly every other class of scientific investigation, such as physiology, geology, mineralogy, agriculture, natural philosophy, &c. The present course has been planned with the idea of giving an insight into that modern branch of science called organic chemistry, to show the valuable and interesting results arrived at by chemists in that department, and to impress upon my hearers the great advantages that society will derive from the progress of these researches, not only in a scientific point of view, but also as bearing upon manufactures and arts; for the manufacturers of the present day are not confined to the employment of mineral matters only in their productions, inasmuch as organic chemistry has placed at their disposal many useful substances which were quite unknown half a century ago, and no doubt many more will be brought to light by men of skill and research as their investigations proceed. This will, however, depend much on the progress of that science itself, which will show to chemists and manufacturers how to obtain from cheap and refuse matters substances which have a value; or, in other words, to produce artificially substances which now exist and are found in the organised kingdom, but the extraction of which is always costly and difficult, owing to the fact that the substance sought for is mixed with a variety of other substances which must be eliminated or destroyed before those substances, the properties of which are useful, can be made available. I shall, therefore, in this course of lectures, try to illustrate by facts the broad statement that science has enabled men already to produce artificially substances which may truly be called organic; and if science has already arrived at this triumphant result—I say "already," for organic chemistry barely dates fifty years back, and we all know that the first steps of a science are the most difficult, and first principles require the greatest effort of the human mind to unravel—if in this short space of time we have succeeded in obtaining a great number of facts by which certain laws have been revealed to us, we have reason to expect and hope that the next fifty years will bring facts and results to light which shall be as profitable, and I may say as astounding, as those which have been discovered of late years by the means of chemistry, and which have been the guidance of manufacturers to many very important applications.

Thus the volatile products obtained from coals were first employed as an illuminating agent. Science and application have gradually brought that illuminating agent to a high state of perfection, and have shown the most economical way of employing it, and the best means of availing ourselves of its illuminating power without interfering with the health and lives of those by whom it is used. Thereby a cheap and effective illuminating agent has been secured to society. At the same time as those volatile and gaseous products are generated water containing various substances is produced, and science having ascertained their nature, we find them converted into alums, sulphate of ammonia, and other commercial products extensively used in agriculture and in manufactures. Further, a dark, noisome, sticky product called tar is also extracted, which at first used to be the great drawback of gas-light manufacture. This product having been examined and studied by chemists, a most valuable series of substances has been gradually extracted and applied to useful purposes. First of all we have pitch, used most extensively for making smooth, clean, and pleasant footpaths, promenades, and even roadways; whilst some of the oily products which pass off are used to preserve the sleepers on our railways, and other materials used in building which it is desirable to preserve from decay. Another solid substance, paraffin, is also obtained, which

is now extensively used as an illuminating agent, and, when mixed with oils, as a lubricator. It has also of late been employed with marked success by Dr. Stenhouse as a substitute for caoutchouc, for preventing the permeation of damp or wet through fabrics. In addition to these, more volatile products are obtained, which were first applied to dissolve caoutchouc and other materials of the same class, and which, in their turn, were applied to a hundred useful purposes. The chemical composition of these volatile products having been further studied, means were discovered for obtaining by chemical transformation a series of colours rivalling in beauty, in cheapness, and in facility of application any dyes which were previously known to the world. Lastly, from coal tar or from coals a most powerful antiseptic agent is obtained, the value of which has been lately demonstrated in the cases of the cattle plague and the cholera. The properties of this substance have not yet been fully ascertained, but in course of time it will prove to be one of the most important yet discovered, owing to its powerful antiseptic properties, for we may consider the root of most of the ailments and diseases of mankind as derived from the decomposition or decay of some of the tissues, and it therefore follows that, in all diseases or decay whose source can be traced to the decomposition of organic matter, carbolic acid must undeniably be the most effective remedy.

Therefore it follows that the most interesting branch of organic chemistry is comprised in the title of this course of lectures, "The Synthesis and Production of Organic Substances by Artificial Means."

The perfect knowledge which chemists have obtained by analysis of the relationship of composition which exists between organic substances has enabled them of late years to produce artificially, or convert substances one into another, which they never could have succeeded in doing had they not had a clear insight into the composition and properties of substances under examination as compared with those they wished ultimately to reproduce.

It now devolves upon me to try to lay before you an outline of some of the methods which chemists have employed to ascertain the composition of an organic substance, and how they are able from that knowledge either to add certain elements to a substance so as to modify its composition and alter its properties, or to subtract certain elements and add instead of them certain others so as to produce new substances, which are identical with those which they want to reproduce or imitate. As it would be difficult for me in the course of an hour to lay before you the details of the system now employed by chemists to effect this end, I shall, therefore, try to give you an idea of that system generally by calling your attention to a new series of facts discovered by one of the most able of modern chemists—namely, the synthesis of organic substances, especially alluding to those which have reference to their reproduction by means of mineral elements; and before this lecture is over I hope you will be able to understand fully how that eminent chemist, M. Berthelot, has succeeded, by employing mineral matters, and by a series of successive chemical reactions, in producing substances which are only derived and obtainable from the organic kingdom either by being extracted direct from their sources of production by a series of chemical manipulations, or which are the result of the destruction of organic substances under the influence of heat or decay.

The first example which I shall have the pleasure of calling your attention to is a gaseous compound called acetylene, or the richest carburetted hydrogen known, for it contains four atoms of carbon for two atoms of hydrogen. Although this product exists always, but in small proportions, in common coal gas, still M. Berthelot asserts—and no doubt with truth—that its presence increases materially the brilliancy of common coal gas, owing to the large proportion of carbon it contains, and which by floating in the flame radiates light and thereby increases its brilliancy. This substance is characterised by giving, with a solution of protochloride of copper dissolved in ammonia, a beautiful coppery precipitate, which is highly explosive. Acetylene, also, when mixed with chlorine, and the mixture is exposed to the action of light, or to any flame containing chemical rays, such as those produced by the combustion of magnesium or sulphuret of carbon, gives rise to violent explosions with the production of hydrochloric acid and a deposit of carbon. This fact I wish you to notice, as it will be, further on, a means of distinguishing this substance from another, one which is the chief illuminating constituent of coal gas, and called ethylene, or heavy carburetted hydrogen. This substance (acetylene) does not exist merely in coal gas. M. Berthelot has proved it to exist in a great number of instances, and to be a constant product of the slow combustion of most organic substances.

Further, this substance offers to us a peculiar interest, for it is the first ever produced by chemists by the direct union of carbon and hydrogen. Up to the time of this discovery, chemists were acquainted with a great number of carburetted hydrogens, either obtained naturally from the organic kingdom—such, for example, as otto of roses, the essences of lemon, bergamot, cloves, neroli, and the solid substances called caoutchouc, gutta-percha, as well as a great number of others obtained through the destructive distillation of organic matters, as well as coals—such as ethylene, amylene, capolene, propylene, &c. M. Berthelot obtained acetylene (as I will show you at the end of this lecture) by passing through a glass globe a slow current of hydrogen gas, in which globe there were the two carbon points of an electrical battery in a state of incandescence, producing what is usually called the electrical light. Under this intense heat and electrical current the hydrogen introduced by him combined with the carbon of the points, and produced acetylene, which he collected by passing it through an ammoniacal solution of protochloride of copper, getting a coppery precipitate, or acetylide of copper, from which he easily isolated acetylene, thus proving to the chemical world the possibility of the artificial production of a carburetted hydrogen.

This discovery, which astonished the scientific world, was soon followed up by a series of facts most interesting to relate. M. Berthelot placed in a small flask, to which was attached a tube to give exit to any gas which might escape, some acetylide of copper, together with zinc and ammonia, and on heat being applied a chemical reaction ensued by which two atoms of hydrogen were added to acetylene, converting it into ethylene or heavy carburetted hydrogen, also called olefiant gas—a name which it derives from the fact that, about thirty years ago, some Dutch chemists having mixed this gas with chlorine and exposed the whole to diffused light, an oily fluid was produced called Dutch liquor, and the fluid having, as just stated, an oily appearance, gave rise to its being called olefiant. This gas is most interesting, owing to its being the chief component illuminating element in common coal gas, and is characterised by burning with a bright flame, with no deposit of carbon, as acetylene does, and when mixed with one equivalent of chlorine, and the mixture is left to itself for some time, the chlorine unites with the olefiant gas, producing the oily fluid above referred to, called Dutch liquor; but when mixed with two volumes of chlorine, and a lighted taper is brought in contact with them, hydochloric acid is formed, and carbon is deposited; further, it is absorbed slowly by sulphuric acid, which property, we shall see presently, M. Berthelot has most judiciously availed himself of to convert it into an organic substance. The olefiant gas, though existing in large quantities in common coal gas, cannot be isolated, owing to the numerous compounds with which it is mixed. Therefore it is necessary to adopt some chemical reaction to produce it in a pure state when its properties are desired

to be inquired into. To attain this end, one part of alcohol is mixed with three parts of vitriol or sulphuric acid, and on being applied each chemical equivalent of alcohol loses two equivalents of water; the remaining element of that alcohol, being olefiant gas, is liberated, and can be examined. What gives interest to this chemical reaction is, that whilst you thus unfold, under the influence of heat, alcohol into olefiant gas and water, you can, if we follow M. Berthelot's process—namely, of placing at the bottom of a large glass globe, a small quantity of concentrated sulphuric acid, and then fill the capacity of the large glass globe with olefiant gas, and keep the same in a constant state of agitation—you will, after having imparted to the vessel some 40,000 or 50,000 rotatory motions, find that the olefiant gas has been absorbed by the vitriol; that it will have fixed two equivalents of water, and that it will have thus converted the olefiant gas into alcohol, which can be isolated by subsequent chemical manipulations. Therefore from carbon and hydrogen you will notice that we first produced acetylene, and this substance we have converted into olefiant gas, and which in its turn has been transformed into alcohol, which alcohol you can easily convert into ordinary ether, as I shall explain to you in my next lecture, or into acetic ether, spirit of nitre, or nitric ether, &c.; or you can also by oxidising convert it into a substance called aldehyde. To convert alcohol into ether, all you have to do is to remove from alcohol one chemical proportion of water, and the elements which remain—namely, one of olefiant gas and one of water—constitute ether.

We can still further pursue these interesting transformations. For if you add four proportions of oxygen to olefiant gas, or if you fix upon alcohol by means of platinum black, or, as I have lately discovered, by means of charcoal in presence of an excess of oxygen, you will convert alcohol into acetic acid or vinegar. It therefore follows that from carbon and hydrogen mineral elements a great number of organic substances can be produced. In fact, from acetylene the following series of compounds have been obtained:—

Acetylene	can be transformed into		(C_4H_2)
Ethylene	„	„	(C_4H_4)
Aldehyde	„	„	$(C_4H_4O_2)$
Acetic acid	„	„	$(C_4H_4O_4)$
Glycolic acid	„	„	$(C_4H_4O_6)$
Oxyglycolic acid	„	„	$(C_4H_4O_8)$
Oxalic	„	„	$(C_4H_2O_8)$

(To be continued.)

ACADEMY OF SCIENCES.

December 24, 1866.

The President announced that the difference of longitude between Newfoundland and Valentia had been determined by Mr. Gould, to whom this duty was deputed by the coast survey of the United States. A preliminary calculation gave longitude of Heart's Content, Newfoundland, in respect to Valentia, 2h. 51m. 56·58. Time occupied by the electricity to pass through the cable, 0·328. These results are not final, but they will only have to undergo very minute corrections. Professor Airey, Astronomer Royal, is about to connect the station at Valentia with the Greenwich Observatory, and Newfoundland being in connexion with the mainland, we shall soon know, within a small fraction of a second of time, the longitude of the Eastern Coast of America.

"*On the General Characters of the Phenomena of Shooting Stars*," by M. Faye.

"*On the Reflection and Refraction of Light*," by M. C. Briot.

"*On the Existence of Perchloride of Lead*," by M. J. Nicklès. The author mixes excess of chloride of lead with solution of chloride of sodium, and then passes a current of washed chlorine. He thus forms a solution containing seven per cent. of $PbCl_2$. The reactions of this solution upon numerous organic and inorganic substances are given in this paper. By agitating the perchloride solution with ether and syrupy phosphoric acid, perchloroplumbic ether is produced; it has an oily consistency, and is very unstable.

"*On a New Class of Compound Ammonias*," by M. A. Wurtz. The isomerism between pseudo-amylic alcohol and ordinary amylic alcohol, which Dr. Wurtz has shown to extend to the ureas, is in this note proved to extend also to the ammonias. He has here described isoamylamine. To prepare it, pseudo-amylurea is heated for some days with very concentrated caustic potash, and then distilled from baryta. The new ammonia boils at 78·5°; its density at zero is 0·755. Like amylamine, isoamylamine possesses a strong ammoniacal odour, it mixes with water, precipitates metallic oxides, and dissolves oxide of copper. The hydrochlorate crystallises in brilliant octahedra, which are efflorescent in the air. The platinum salt is very soluble in alcohol; this distinguishes it from amylamine, the platium salt of which is insoluble. The gold salt is also soluble.

NOTICES OF BOOKS.

The Management of Steel. By George Ede, employed at the Royal Gun Factories Department, Woolwich Arsenal. Fourth Edition, revised and enlarged. London: William Tweedie. 1866.

This is a thoroughly practical work, written by one who is intimately acquainted with the subject of which he speaks, and is not merely content with laying down rules, but gives the reasons for them, so as to make their operation clearly intelligible to his readers. It treats of the whole of the processes connected with the use of steel; its manufacture, forging, casting, annealing, tempering, and the manufacture of the various articles to which it is chiefly applied, with chapters on the case-hardening of wrought iron, and the toughening of steel for guns, railway bars, &c. The tempering of hardened steel is described at considerable length, especial attention being given to the use of oil for this purpose, which for many articles is a much more sure method of getting the correct temperature than simply observing the different changes of colour taken by the polished surface. Thus, when first the oil commences to smoke, the temper would be that of a straw colour, or about a temperature of 450° Fahr. A darker and more abundant smoke indicates a brown temper, or 500°. A purple temper, about 530°, is shown by a still more abundant and black smoke. A blue temper is reached when the oil takes fire on the application of a flame, but ceases to burn on its removal; this shows a temperature of about 580°. The usual temper for springs is shown by the oil taking fire and continuing to burn; while, if it is allowed to burn itself away before the articles are removed, it imparts the temper which clockmakers mostly use for their work, where the steel is scarcely harder than in its natural state. When a tool is required especially hard, redhot lead is recommended to heat it with, the tool itself being first raised to a dull red heat and hammered; of course, when withdrawn from the lead, it must be quenched as usual in cold water.

Many hints are given for particular descriptions of work, and some valuable advice as to selecting steel; and the popularity of the work in its present enlarged form may be safely inferred from the rapid sale of the previous edition.

Retrospect of Medicine. (July-December, 1866.) Edited by W. Braithwaite, M.D., and James Braithwaite, M.D. Lond. London: Simpkin and Co. 1867.

We always welcome Dr. Braithwaite's half-yearly volumes warmly, because they serve as an index of modern medicine, its progress, or the contrary. By comparing it with the volumes of some years back, we see with pleasure the increasing philosophical spirit leavening the science, mainly owing to the study of chemistry and physics. At the same time, we have to deplore blunders that would never have been made but from the want of chemical knowledge. We find notices of the surgical uses of liquid glass, fanciful as it may seem. A paper reprinted from the *Medical Press and Circular*, with the taking heading of Electro-Therapeutics, we were disappointed to find contained only a rather old theory of static electricity—nothing more. An interesting summary of Wagner's method of separating the sulphates of various alkaloids from broths, &c., is reprinted from the *Lancet*. But the novelty of the volume is the report of a case of poisoning by *charcoal vapour*. The reasoning for the assumption of the presence of this vapour of charcoal we find to be as follows:—"As the products of the combustion of charcoal may differ very much in consequence of variations in the supply of oxygen, it would seem that in this case the gases were either too much diluted with air to produce the ordinary effects, or that some of them (possibly carbonic oxide) may not have been formed." This cautious statement does not warrant the heading given to the case. The probably great uses of iodised cotton are shown, and a special feature of the volume is the rational treatment for the disintegration of cancer cells by the various methods of nitric and acetic acid injection, and the continuous galvanic current, as opposed to treatments for absorption or elimination. The cholera notices are not very exhaustive. We have quoted a few passages to illustrate our remarks, and we think that our readers will be enabled to verify them to a large extent by the study of the volume, which we can recommend for the purpose.

Uncontrollable Drunkenness as a Form of Mental Disorder. By Forbes Winslow, M.D., D.C.L. Oxon. London: Robert Hardwicke, 192, Piccadilly. 1866.

This pamphlet is an enlargement of three letters lately published in the *Pall-mall Gazette*. Its purport is to show the advantages to be obtained by sanatoria for oinomaniacs. It is written in popular language, and will interest all readers—we hope not too strongly, for we find two per cent. of lunacy cases caused by abuse of alcohol to be entered as suffering from *stupidité* by a foreign observer. We hope that it will prove interesting to the readers of the Chemical News generally, and in no way specially.

The Year Book of Photography, and Photographic News Almanac for 1867. Edited by G. Wharton Simpson. London: Photographic News Office.

All that we need say of the present volume is that it keeps up to the standard of the former. No very important novelty has lately appeared in photography, which has had the dulness of the summer against it, and, as a trade, has shared in the general stagnation of the year. Many valuable articles are contributed by eminent photographers on the proper management of the most approved processes, and additional information is given about Swan's Carbon Process. Altogether, we think it will be found a very fair compendium of the present state of the science.

Lectures at the School of Gunnery.—In November last a course of lectures "*On the Metals and Alloys used in the Manufacture of War Matériel*" was delivered by Mr. J. Spiller at Shoeburyness; and Mr. E. O. Brown will commence early in February next a course of four lectures "*On the Manufacture and Properties of Gunpowder and Gun-cotton.*"

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften zu Wien (Mathematical and Natural History Section). Vol. 54, div. 2.

June, 1866.—"*Analysis of the Water and Gases of an Artesian Well at Vienna*," by J. Oser, F. Reim, and P. Weselsky.—"*On the Equivalents of Cobalt and Nickel*," by E. von Sommaruga.—"*On the Laws of Solution, on the Boiling of Water, and on Boiler Explosions*," by F. Pless.—"*Contributions to the Knowledge of the Hen's Egg*," by S. Stricker.—"*On the Scientific Applications of Photography and the Stereoscope*," by E. Mach.—"*Contributions to the Knowledge of Luteoline*," by F. Rochleder.—"*On the Theory of Vision*," by E. Mach.

Monatsbericht der königlich-Preussischen Akademie der Wissenschaften.

July, 1866.—"*On the Reduction of Aromatic Compounds by means of Zinc*," by Baeyer.

Journal für praktische Chemie.

September 30, 1866.—"*On the Basic Acetates and Nitrates of Lead*," by J. Lowe.—"*On the Nature of the Vapour of Phosphorus*," by W. Schmid.—"*On the Gases evolved by the Action of Heat from various Solid Bodies*," by E. Blumtritt.—"*On the Estimation of the Gases absorbed by Solids*," by E. Reichardt.—"*On the Quantity of Cobalt and Nickel contained in Iron*," by H. Weiske.—"*On the Action of the Alcohols on Terchloride of Phosphorus*," by N. Menschutkin.—"*Observations on Benzoin*," by N. Zinzin.—"*A New Photographic Developer*," by J. Schnauss.

October 22.—"*On Grönhartine, a Colouring Matter probably Identical with Taiguic Acid*," by W. Stein.—"*On a New Compound, called by the Discoverer Glutaminic Acid*," by Werther.—"*On the Behaviour of Liquid Hydrocarbons and Fats towards Dry Oxygen;*" "*Supplementary Observations on the Quantity of Oxygen contained in Amber and some other Resins*," by C. F. Schönbein.—"*Remarks on Marignac's Researches on Niobium and Ilmenium*," by R. Hermann.—"*On the Tantalium Compounds*," by C. M. Marignac.—"*On Columbite and Tantalite*," by Blomstrand.—"*Tool for cleaning the Insides of Glass Retorts;*" "*On the Formation of a Sesquicarbonate of Soda and Potash;*" "*On the Separation of Rubidium from the Mother Liquors of Saltpetre;*" "*On the Use of Paraffin in certain Crystallisation Experiments;*" "*On the Precipitation of Nickel as a Sulphide;*" "*A New Method of preparing Sulphurous Acid*," by F. Stolba.—"*On the Estimation of Chloric and Chlorous Acid*," by H. Toussaint.—"*On Oxamate of Ammonia*," by L. C. de Coppet.—"*On a Sulphate of Cobalt with Four Equivalents of Water*," by A. Fröhde.—"*On Kainite, a New Native Potash Salt, and Kieserite from Stassfurt*," by Rammelsberg.

November 10.—"*On the Composition of the Topaz;*" "*On the Composition of Lievrite, together with some Remarks on the Formulæ of the Silicates*," by G. Staedeler.—"*On Pennine;*" "*On the Composition of Wiserine;*" "*On some Constituents of the Mineral Waters of Ems*," by V. Wartha.—"*Analysis of Mineral Waters from the Oberbrunnen and Mühlbrunnen at Ober Salzbrunn, Silesia*," by W. Valentiner.—"*On the Changes of Sulphate of Iron when exposed to the Air*," by F. Muck.—"*On Acetic Acid*," by A. Geuther.

Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt.

April-June, 1866.—"*On the Iron Ores of Gyalár, Tran-*

sylvania," by B. von Winkler.—"*On the Geology of the Neighbourhood of Kirchberg and Frankenfels, Lower Austria,"* by M. von Lipold.—"*On the Eastern Portion of the Schemnitz Trachytic Mountains,"* by K. M. Paul.—"*Report on a Geological Survey, carried on during the Summer of the Year 1864 in the Thurocz Palatinate, and in the Neighbouring Portions of the Trentschin Palatinate,"* by F. von Adrian.—"*On the Geology of the Neighbourhood of Bujták, Ecseg, and Herencsény,"* by J. Böckh.—"*Barometrical Measurements of Heights in Lower Austria,"* by L. Hertle.—"*Gold and Silver Mining at Kremnitz, Hungary,"* by E. Windakiewicz.—"*Analysis of Trachyte and Rhyolite from the Neighbourhood of Schemnitz, Hungary,"* by E. von Sommaruga.—"*On the Quantity of Ash contained in Graphite,"* by Schöffel.

NOTICES OF PATENTS.

An Improvement in the Manufacture of Ice to fit it for making Effervescing Drinks. Oliver Weldon Jeyes, Stockton-on-Tees, Durham. March 17, 1866.

This received provisional protection only, and is described as follows:—

"My invention consists in the manufacture of ice from water or other suitable liquid impregnated with carbonic acid gas. I partly fill a vessel with the water, into which I force carbonic acid gas. I then hermetically seal the vessel, freeze the contents into a solid state, open the vessel and remove the ice, which may be employed in more or less large blocks in drinks to be made effervescing."

The fallacy of this will be at once evident to any chemist, it being well known that liquids impregnated with carbonic acid gas give it all off when frozen. However, as the specification is worded, the invention may be said to be a *bonâ-fide* one. Probably ice has never before been prepared by this method; and if a vessel of sufficient strength were used, it might be produced in this way, after which it could be "employed in more or less large blocks in drinks to be made effervescing." Doubtless the means of making the drinks effervescing will be given in a future patent. Meanwhile we should imagine that the late frost, by enabling people to procure ice in a rather simpler manner, will somewhat hinder the immediate adoption of this process.

CORRESPONDENCE.

Commercial Analyses.

To the Editor of the Chemical News.

Sir,—A letter in your last number, headed "Determination of Phosphates," bears upon a question of interest to commercial analysts. The discrepancies adverted to by the writer between the results of "high" and "low" analysts can scarcely be obviated whilst a full analysis is expected for an inadequate fee. The complete analysis of a superphosphate, especially when it contains moisture, free sulphuric acid, and organic matter, is a difficult problem, and even the most correct way of arranging the results obtained is open to doubt. It is a great pity that a general understanding cannot be arrived at to sell phosphates of all kinds by degrees (per cents.) of phosphoric acid, "soluble" and "insoluble," as is done with alkalies. This would afford sufficient information for the dealer and practical man, whilst the chemist could afford to bestow more care on this single determination.

Again, the discrepancies (possibly to the extent of several per cents.) between the results of different analysts often arise from variations in the amount of adventitious moisture, due to changes in the humidity of the air, or to the manner in which the sample was drawn, whether from the surface or interior of the bulk, and so forth. It would be extremely desirable for analysts invariably to determine the loss of weight on drying in a steam oven, which involves but little extra trouble. The results could then be stated in two columns—(A) expressing the composition of the sample as received, which would be the data for the buyer and seller; and (B) the same calculated to what it would be after drying at 212°. The latter figures would allow of a far more exact comparison being made between different analyses, as all the effect of varying humidity would be got rid of. I have occasionally sent in analyses so arranged, but, unless the practice were general, little is gained by it. A proposal from an organisation such as the Chemical Society might bring about a general agreement among chemists on such points of detail.—I am, &c.

Frederick W. Griffin, Ph.D.

Bristol School of Chemistry.

Test for the Purity of Glue.

To the Editor of the Chemical News.

Sir,—In your last publication a good test for judging the quality of glue is asked for by a correspondent signed "J. S." There are few really good methods for accomplishing this. I have examined a large number of samples, and have tried to precipitate the gelatin, of which the glue is in great part made, by alcohol, tannin, solutions of metals, &c., but find that none of these serve the purpose for effecting a rapid determination. The best and quickest mode is to transform the nitrogen of the gelatin into ammonia by heating the glue with soda lime, and receiving the products into dilute sulphuric acid and neutralising. This is the work of a little more than one hour, and affords a very satisfactory result. Should your questioner not be practically acquainted with the estimation of material by the soda-lime process, I shall be glad, since he writes from Glasgow, to show him the method.

I am, &c. R. Carter Moffat.

Analytical Laboratory, 108, Ingram Street, Glasgow.

To the Editor of the Chemical News.

Sir,—In answer to "J. S.'s" inquiry, allow me to state the question of determining the relative value of glue has been examined and solved in an admirable paper by H. Weidenbusch. I do not recollect having seen any English translation of this paper, but it is published in *Dingler's Polytech. Journal*, vol. clii. p. 204; *Chemisches Centralblatt*, 1859, p. 434; and *Wagner's Jahresbericht der chemischen Technologie*, 1859, p. 575. The apparatus required for the determination of glue is manufactured by Mr. Desaya, the well-known philosopical instrument maker at Heidelberg. I am, &c. F. V.

Camden Square.

Amalgamation of Iron.

To the Editor of the Chemical News.

Sir,—I have read with great interest your notice of the experiments made by M. J. Nicklès in amalgamation. As I have had occasion, in making some electro-metallurgic experiments, to try if by some expedient it might be possible to amalgamate iron, I can add that iron may be, as it were, superficially amalgamated—not only by the two expedients mentioned by M. Nicklès, but also by first rubbing the iron with a piece of clean copper till it is coloured by the copper; also with tin, with common solder, and with lead. But iron takes the mercury better if slightly alloyed on the surface with tin, with an alloy of lead and tin, or with an alloy of tin, nickel, and copper, and probably with other alloys; but these are the only metals and alloys that I have tried.

Now in these cases I never thought that the iron, properly speaking, was at all amalgamated, but simply that the superposed metal was amalgamated. But M. Nicklès thinks that it is, and that it is due to electricity by means of an electro-positive metal being applied to it.

Well, zinc is certainly positive to iron in sulphuric acid and water, but ordinary brass is not; and certainly the brass of which scratch brushes are usually made is not. Very common brass is, no doubt, where the proportion of zinc is very large; but copper is negative, and lead is negative, and common solder is negative; yet with all these, when they are rubbed into the iron, amalgamation takes place equally well. Therefore, I think the result cannot be said to be an electrical one.

My notion has been, after very many experiments, that amalgamation is simply the dissolving of any metal (which is capable of being so dissolved) in mercury at ordinary temperatures. Now, I believe iron will not so dissolve, consequently is not capable on that view of amalgamation; for if, after this so-called surface amalgamation has been performed, sufficient time be given, and if there be sufficient mercury present, the whole amalgamable metal on the surface becomes dissolved, and it may be wiped off, and the iron remains just the same as it was before the operation. When the surface of the iron has been slightly alloyed with the before-mentioned alloys, this cannot be done, for the alloy penetrates the iron, and enables the mercury to do so.

That iron is not amalgamable I think may be inferred from what M. Nicklès says of it—namely, that it is not penetrated by the mercury, which it would be if amalgamation took place; though it were never so slight a film, the mercury must gradually diffuse and lose itself in the iron: a surface alloy of tin on iron does so. I have seen it stated before that iron can be amalgamated by some battery process. I should like to know the mode of operation. I am, &c.

J. Baynes Thompson.

Iodine in Mineral Phosphates.

To the Editor of the Chemical News.

Sir,—In answer to "Smatterer," I beg to state that iodine is known to be present in the phosphorite of Nassau, and it will be found upon reference to Mohr (*Geschichte der Erde*, page 514) that he cites this fact as evidence in favour of the view that this phosphorite is of marine origin.

I am, &c. F.

MISCELLANEOUS.

Composition and Quality of the Metropolitan Waters in December, 1866.—The following are the Returns of the Metropolitan Association of Medical Officers of Health:—

Names of Water Companies.	Total solid matter per gallon.	Loss by ignition.*	Oxidisable organic matter.†	Hardness.	
				Before boiling.	After boiling.
Thames Water Companies.	Grains.	Grns.	Grains.	Degs.	Degs.
Grand Junction	20·17	1·00	0·82	14·5	6·0
West Middlesex	21·00	0·90	0·64	15·0	8·0
Southwark & Vauxhall	21·08	1·98	1·82	14·5	6·0
Chelsea	19·96	1·25	0·82	14·0	6·0
Lambeth	19·83	1·49	1·34	13·5	5·5
Other Companies.					
Kent	27·38	1·10	0·00	17·0	8·5
New River	21·58	0·90	0·80	14·5	5·0
East London	23·49	1·50	1·16	15·0	5·0

The water derived from the Thames and supplied to the metropolis during the month of December has contained less saline matter than it did in the preceding month; but that derived from other sources than the Thames has contained a little less than the usual proportion. In every case, however, the quantity of organic matter has been above the average, and as it is entirely of a vegetable nature it has no doubt been derived from the decaying leaves of autumn.

The fluctuations which take place in the quality of the water during the succeeding months of the year are sufficiently marked to indicate the influence of the seasons. This may be seen from the following table, which exhibits the average composition of the water supplied to the metropolis by the Thames companies during each of the twelve months of the last two years:—

Months.	Total solid matter per gallon. Grains.	Oxidisable organic matter. Grains.
January	21·22	0·79
February	21·61	0·67
March	20·45	0·73
April	19·58	0·49
May	18·99	0·47
June	18·49	0·62
July	17·28	0·63
August	17·57	0·59
September	17·51	0·61
October	18·80	0·62
November	20·56	1·04
December	20·78	1·01

So that from October to February the total amount of solid matter in the water gradually rises to its maximum, which is rather more than 21 grains per gallon, and then it as gradually declines until at the beginning of summer it is no more than about 17 grains per gallon. Throughout the months of July, August, and September, it remains at nearly the same proportion, and then with the advance of autumn it slowly increases.

The quantity of organic matter in the water is at its maximum in November directly after the fall of autumn leaves, and its minimum is in the month of May. The same facts are observed with the water supplied by the New River and the East London Companies, whose sources of supply are very nearly of the same quality as the Thames; but it is not so with the deep chalk water of the Kent Company.

At the close of the year it may be interesting to review the results of our investigations into the character of the water supply of the metropolis during the last twelve months, and to compare it with what it was in 1851, when the last Government Commission was appointed to examine it. At that time the population of London was 2,362,236, and the quantity of water daily supplied by all the metropolitan companies was 45,885,900 gallons. This was at the rate of 19·4 gallons per head. At present the estimated population of London is 3,067,536, and the average daily supply of water is 92,734,000 gallons, which is at the rate of a little more than 30·2 gallons per head. As far, therefore, as quantity is concerned, the increase is considerable, for it is nearly 60 per cent. on the average daily supply of 1851; in fact, while the population of London has increased during the last fifteen years to the extent of only one-third, the water supply has been more than doubled. And so also with respect to the quality of the water—this likewise has undergone a marked improvement. In the year 1851, the average proportion of solid matter in the Thames supply was 21·43 grains per imperial gallon, whereas in the year which has just expired it has been only 19·64 grains. The same is the case with the water obtained from other sources than the Thames; for the amount of solid matter in the Kent water has fallen from 29·71 grains per gallon to 27·01, in the New River from 19·50 to 18·97, and in the East London from 23·51 to 20·81. But the most important improvement has been in the reduction of organic impurity. In 1851, the quantity of organic and other volatile matter

* The loss by ignition represents a variety of volatile matters, as well as organic matter, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

† The oxidisable organic matter is determined by a standard solution of permanganate of potash, the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

dissipated by heat from the solid residue of the Thames supply was 2·46 grains per gallon; in 1866 it has been only 1·05 grain. In the Kent water it has declined from 2·61 grains per gallon to 1·04; in the New River water from 2·79 to 0·89; and in the East London water from 4·12 to 1·04. These facts are best illustrated by the following table:—

Comparison of the Quantity and Quality of the Water supplied to the Metropolis in 1851 and 1866.

Population	1851—	2,362,236
	1866—	3,067,536
Average daily supply	1851—	45,885,000 gals.
	1866—	92,734,100 ,,
Do., do., per head	1851—	19·4 gals.
	1866—	30·2 ,,

Companies.	Years.	Total solid matter per gal.	Organic matter, &c., lost by heat.	Hardness.	Average daily supply.
		Grs.	Grs.	Degs.	Gals.
Grand Junction	1851	21·72	3·07	14·0	3,541,700
,, ,,	1866	19·74	0·98	13·1	8,551,800
West Middlesex	1851	22·67	2·75	14·6	3,334,000
,, ,,	1866	19·32	0·95	13·0	8,102,300
Southwark and Vauxhall	1851	21·08	1·51	15·0	6,013,700
,, ,,	1866	20·02	1·02	13·0	12,367,000
Chelsea	1851	21·28	2·38	14·4	3,940,700
,,	1866	19·31	0·94	13·0	7,748,000
Lambeth	1851	20·40	2·59	14·2	3,077,300
,,	1866	19·83	1·16	13·0	8,694,100
Kent	1851	29·71	2·61	16·0	1,079,300
,,	1866	27·01	1·04	18·3	5,927,200
New River	1851	19·50	2·79	14·9	15,435,600
,,	1866	18·97	0·89	14·1	22,729,700
East London	1851	23·51	4·12	15·0	7,036,000
,,	1866	20·81	1·04	14·8	18,614,000

This improvement in the quality of the water has been effected in three ways—first, by selection of better sites for the collection of the water; second, by careful processes of filtration through acres of fine sand, &c.; and third, by the storage of the filtered water in covered reservoirs. Whether other improvements can still be effected is a subject for careful inquiry, and it is likewise matter for calm and deliberate investigation whether the water supply has had anything to do with the recent epidemic of cholera. On this head the Medical Officers of Health of London, and especially those who have been most engaged with the disease, will be best able to give an opinion. Already, indeed, an opinion has been expressed by the Health Officers of the Eastern districts of London, where the epidemic was most severe, and it does not accord with the popular hypothesis. H. Letheby, M.B.

The Chemical Trade in 1866.—We glean the following from Mr. W. Caudery's circular:—

Amidst the gigantic explosions which have characterised the year 1866, it is pleasing to record a satisfactory result in the chemical trade.

Alkali or Soda Ash.—No. 2 opened at 2¾d., declined about the middle of January ⅛d., but at the end of February excessive orders from the United States caused an advance of ⅜d. per cent., which was well maintained during the whole of March and April. In the middle of August 2⅝d. was accepted; 2⅝d. was paid during September and October, and 2¾d. in November and December; the present quotation being 2⅝d. ex ship. No. 1 was sold at the usual difference of ¼d. per cent. additional. Most of the Liverpool manufacturers have contracted for their full productions during the present year at prices ranging from 2½d. to 2⅝d., and as the Newcastle makers have also entered into engagements for the same period for a portion of their manufacture, the prospects are in favour of the present high prices being sustained.

Caustic Soda.—In January, 1866, the quotation was 20s. for 60 to 62 per cent., until the middle of July, when 18s. was reached, the lowest point during the year; from this it gradually advanced to 20s. 6d. at the end of September (its highest price), receding during October, November, and December to 19s. per cwt., present value.

Soda Crystals.—During the first five weeks 5*l.* 12s. 6d. was the quotation, but it advanced till the end of March, when 6*l.* 17s. 6d. was obtained. At the end of June the lowest quotation, 5*l.* 7s. 6d., was reached. Towards the end of July, an advance of 25s. per ton was at once established; from this during August to December a decline of about 20s. per ton, or 5*l.* 10s. ex ship, was submitted to, at which there are buyers for all next year, but manufacturers generally prefer waiting the chance of markets than contract, and within the last few days have advanced the rate to 5*l.* 15s. for present delivery.

Bicarbonate of Soda opened in January at 19*l.* To the end of June it gradually gave way to 16*l.* 10s., and remained so till the middle of September. 21*l.* was obtained early in November; from this it receded to present price of 18*l.*, ex ship, here.

Bleaching Powder.—During the entire year the demand has not only been extensive, but was materially increased, and although supply about kept pace with demand, high prices have ruled throughout, especially during the summer months. At the beginning of the year 14*l.* was paid, but this gave way 10s. per cwt. during January, and a further reduction of 10s. was accepted in the middle of February, when it reached 13*l.*; from this it gradually recovered until May, when 16*l.* 10s. was paid, at which, with occasional fluctuations of 10s. per ton, it remained during June, July, and August; after this consumption slackened, price declined, and 14*l.* 10s. has been the quotation since.

Tartaric Acid was quoted 1s. 6d. first of January, and 1s. 4½d. end of June; from July to December it further receded 1d., present price being 1s. 3½d.

Citric Acid met with a steady sale, 2s. 1d. being the opening, and 1s. 11½d. the closing quotations.

Oxalic Acid and Sal Acetos.—Both realised extreme rates; for the first half-year 1s. was obtained for the former, and 1s. 2d. the latter, but during the last six months they gradually gave way to 10d. and 1s. respectively. 10½d. and 1s. 0½d. may be quoted as the prices of the day.

Potash.—Bichromate sold at 6d. during the spring, but 5½d. was accepted during the last eight months of the year. *Chlorate* at the commencement of the year was quoted 1s. 2d.; present value, 1s. 0½d. *Prussiate:* Yellow from 1s. 1½d. to 1s. 0½d., the latter being the closing quotation. *Muriates:* Opening value was 9*l.* 10s., but 8*l.* was reached in September, at which it still remains.

Iodine, on January 1, was 7½d. 9¼d. was obtained in September, at which it remains.

Quicksilver.—During the first four months it was quoted at 8*l.* per bottle; at the end of April the price was reduced to 7*l.*, at which it has since remained, but with occasional sales at 6*l.* 17s. 6d.

Sulphate of Quinine.—During January prices advanced 2d. per ounce from opening quotation of 5s.; from this it gradually drooped in value till the present low quotation of 4s. 4d. was reached.

Refined Camphor.—In January it was 1s. 7d. per lb., June 1s. 6d.; during the last six weeks it reached 1s. 11d.

Cream Tartar.—In January it opened at 105s., and closed in December at 83s.

Sulphate of Copper.—The value has gradually fallen. In January it was 32s.; in December, 25s. to 26s.—present prices. The rough market also in the same way declined, best selected having been sold at 80s early in December—the lowest price known for the last 20 years; but on the 24th, same month, an advance of 5*l.* per ton was established.

Refined Borax.—Prices improved during the first month from 54s. to 60s., and remained at this latter till April, when 65s. was required. On December 17 a further advance of 5s. took place, the price being now 70s.

Ammonia.—Sulphate: Best white was 13s. 6d. in January, and 11s. 6d. in December—present value; brown and grey 10s. per ton less. *Carbonate* remained stationary at 5d. throughout the year, but the discount varied from 2½ to 10 per cent., according to quantity; the makers being behind in their deliveries, any increased demand must advance prices.

Sal Ammoniac.—The quotations for firsts and seconds continued at 37s. 6d. and 35s. 6d., with a steady demand, throughout the year.

Alum.—The opening price was 7s. 3d. for lump, and 8s. 3d. ground, but on February 14 5s. advance was obtained, making the former 7s. 6d., and the latter 8s. 6d., at which it still remains.

Sugar of Lead.—White opened at 38s., and closes at the same price; grey at 32s. in like manner; brown opened at 26s., and so continued till November, but there being a scarcity of this quality, 30s. to 32s. was required in December—present prices.

Arsenic.—Lump opened at 12s., and gradually advanced to 15s. in May, at which it remains. Powdered opened at 5s. 9d., and, in unison with lump, advanced in May to 6s. 6d.—present price.

Naphtha.—Vegetable, 4s. 3d. in January to 3s. 9d. per gallon in August, recovering to 4s. 3d. in November, at which it remains. *Mineral:* Scarcely any sale, price being nominally 2s. to 2s. 6d.

Green Copperas.—From 55s. to 65s., according to quality.

Saltpetre gradually declined in value all the year; 12,048 tons were landed, against 11,479 tons in 1865, and against 10,843 tons delivered in that year, 9812 tons were delivered in 1866. The stock now is about 10,000 tons, against 8000 tons in 1865. About 1400 tons are afloat from Calcutta, which is rather less than the quantity afloat same period last year; from Bombay scarcely any shipments are reported. Bengal petre, which was quoted at 24s. to 25s. 3d. the first week in January, has fallen step by step till last week; its highest quotation was 18s. 6d. to 20s. 6d. per cwt. Bombay is nominally quoted at 15s. to 18s. per cwt., against 19s. to 20s. 6d. in December, 1865. Refined has followed the downward tendency of raw—opening at 28s. 6d., it closes at 24s. per cwt.

Nitrate of Soda has fallen 2s. per cwt. during the year; in January the quotation was 13s. 6d., in December 11s. 6d. to 12s. The present stock is about 1200 tons, against 1900 tons last year.

Brimstone.—Prices commenced at 8*l.* 5s. for best seconds, and fell to 6*l.* 10s. towards September. In December an advance of 5s. left the closing value 6*l.* 15s. per ton. Refined roll has varied 6d. per cwt. only through the year, commencing at 10s. 6d., dropping to 10s. in September, and recovering 3d. in December, leaving present quotation 10s. 3d. per cwt. Flowers of sulphur have continued at 12s. 3d. to 13s., the former being present quotation.

Sulphuric Acid continued in active but steady demand at ¾d. to 1d. per lb., with discount varying according to circumstance.

New Chemical Toy.—"Pharaoh's serpents" and "Vesuvian tea" have paved the way for the reception of a new Chinese wonder in the shape of "ferns growing out of burning paper." This is a neat little experiment, free from many of the disadvantages appertaining both to the "Devil's tears" and the lozenge-shaped crystals of bichromate of ammonia, which may chance to prove too inviting to children's tastes. The instructions direct us to crimp or fold the yellow papers backwards and forwards, so that when opened out they may be supported upright in a zigzag form. One of these slips is then placed upright on a plate, and ignited in two or three places along the upper edge, but without being allowed to blaze. It will burn slowly down with a red glow, diffusing an agreeable perfume, whilst the ash of the paper assumes the most fantastic arborescent shapes, together with a green colour, which, to a lively imagination, may be suggestive of the growth of ferns or lichens. We had no difficulty in imitating this effect by saturating thin cartridge paper, in the first instance, with an alcoholic solution of gum benzoin, and, when dry, applying an aqueous solution of the bichromate of ammonia. The decomposition of the latter substance by heat in contact with burning paper affords an explanation of the phenomena observed.

Chemical Society.—The next meeting of the Society will be held on Thursday evening, at 8 o'clock, when the following papers will be read:—"*On the amount of Carbonic Acid in Sea-air*," by Mr. Thomas E. Thorpe. "*Synthetical Researches on Ethers*," Part II., by Professor Frankland and Mr. Duppa. "*Laboratory Contributions*," by Professor Wanklyn.

Gold by the Hundredweight. — A telegram from a friend at Placerville assures us that gold worth 50,000*l.* was taken from the Woodside quartz mine, near Georgetown, and that yesterday the miners were "blocking out nearly a pure solid mass of gold, three feet in length." If such a statement had come from a stranger we should have received it with incredulity, but we can vouch for the sincerity of the author of the message.—*Alta Californian.*

ANSWERS TO CORRESPONDENTS.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. 6d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

J. O.—We have never heard of a substance possessing the properties you speak of. You must have been erroneously informed.

Felix.—According to Schönbein, peroxide of manganese is an antozonide.

Sydney Hall.—A large spectroscope, with the telescope replaced by a box for holding the objects to be insolated, will answer your purpose. It should be mounted equatorially, so as to point readily to the sun.

Pt.—Send your damaged crucible to Johnson and Matthey, Hatton Garden, and they will probably be able to repair it for you. The hole can be soldered up with spongey gold.

Extraction of Grease.—If CS_2 will address the undersigned, stating full particulars of his requirements, information will be afforded him as to the apparatus necessary, and where it can be obtained. Jesse Fisher, Ironbridge, Salop.

Flox.—Sulphate of lead is decidedly soluble in pure water. At 11° C. one part dissolves in 22,816 parts of water. This solution is darkened by sulphuretted hydrogen. If sulphuric acid be present, the solubility is diminished, one part then requiring 36,504 of water. The presence of ammoniacal salts still further diminishes the solubility.

Arrangement of Chemical Specimens.—A Student writes:—"It would be a boon to me, as well as, I have no doubt, to many other amateurs in chemistry, if some of your learned readers would give me a few hints as to the best plan of arranging chemical specimens. Bottles are expensive and require shelves on which to display them, and there they get dusty. Corked glass tubes are very convenient, but they are awkward for labelling, and when put away it is difficult to find a specimen. Wealthy chemists and those with whom museum space is plentiful can indulge in stoppered bottles of graduated sizes, ranged one behind another in glass cases; but such luxuries are entirely out of the reach of young beginners, whose space and pocket-money are alike limited."

Received.—T. P. Blunt, F.C.S., too late for insertion this week.

LONDON WATER: PAST, PRESENT, FUTURE.

PAST.

We propose to bring before our readers this question in an impartial manner, and to judge it upon its merits, as shown by evidence. Nor would we be so unfair as to consider the chemical evidence to the exclusion of the medical, if it be true that chemistry cannot supply the test for poison shown to be in water by its effects. As regards the past, Mr. Simon, in a report on two cholera epidemics as affected by the consumption of impure water, remarks—"An experiment has been conducted during two epidemics of cholera on 500,000 human beings. . . One half was doomed in both epidemics to drink the same fecalised matter, and illustrate its fatal results (1848-49 and 1853-54); while another section, freed, in the second epidemic, from that influence, was happily enabled to evince by a double experiment the comparative immunity which a cleanly beverage could give." To which is added in the *Lancet* report—"The population drinking dirty water suffered three and a half times more mortality than that drinking other water." At that time London was supplied by Thames water as practically as it is so now in a large measure. The classical inquiry into the state of the London water conducted by Professors Hofmann, Graham, and Miller, was made at a time about midway between these two outbreaks (1851). The results were as follow:—The percentage of nitrogen was given in two cases, in such a way as hardly to be relied upon, "and on such evidence a minute and probably unimportant portion of *animal* organic matter would be admitted to be present;" none had any marked taste or colour; no animalcules were observed in any case, with the statement that the time of year was unfavourable to such observation. The hardness of the water was shown to be temporary and permanent in character (sixteen degrees of hardness from sulphate of lime in the Kent water), and this hardness was shown to be "remarkably uniform."

It may safely be stated that no sufficient grounds exist for believing that the mineral contents of the water supplied to London are injurious to health. The water may be circulated through leaden pipes with an unusual degree of safety from this hardness, and iron is protected by the alkaline character of the salts in the water. Putrefactive decomposition occurs less rapidly in hard than in soft water, and it may be more safely preserved in reservoirs on this account. The supply is *limitless* (although the Thames is fed by no great lake), and this is nearly independent of the season, on account of the water by which the Thames is fed being from a chalk soil.

The water was reported as being defective as regards temperature (sometimes above 70° F.); promoting decomposition of organic matter; taste of vegetable matter after floods; and vegetable discolorations, "which do not originate on a barren non-retentive soil—an evil to be obviated by a restricted area—with storage of excess from floods in large reservoirs." Pollution by sewage and surface drainage ("the diverting the sewage of the various towns entirely from the Thames need not be taken into account, from the great difficulties in the way"), *for the indefinite dilution of such matter in the vast volume of the well-aerated stream is likely to lead to their destruction by oxidation.* However, the evil is shown to be likely to increase, and "it seems to be only a question of time when the sense of violation of the river's purity will decide the public mind to the entire abandonment of the Thames as a source of supply, unless artificial means of purification be in the meantime devised and applied. This very significant passage we also find in the Report. "Although, according to chemical analysis, the organic matter never appears to rise in the water of the companies who filter, to a proportion by weight which need elude the chemist, and although it may be impossible to ascertain its origin, still the balance of evidence appears adverse to the conclusion *that what is known to enter is immediately destroyed.*" Thus the hardness of the water is useful only for the carrying away of the matter, not for preserving this organic matter to putrefy in the human body. Refuse from gas and chemical works, not admissible in ordinary sewers, and navigation, and river population also, now pollute the river. The disadvantages of hard water are shown fully, and it is useful to compare these statements with that of Mr. Bateman, who says that the Glasgow water in London would save no less than 400,000*l.* per annum in the use of soap, soda, tea, coffee, and chemical substances.

Filtration was shown to be absolutely necessary to the purification of the water, sand filtering being insufficient, clay and loam (suggested by Professor Way's researches) inapplicable, whilst liming reduced the hardness in one case from 15·5 to 3·6 degrees of hardness (Clarke's method) the process falling in easily with "the routine operations of waterworks." Water so treated "could not be distinguished in its sensible properties from pure spring water of equal softness." This process would not supersede the necessity for sand filtration. The two processes combined could not remove the yellow-flood tinge, or abate the taste of vegetable matter.

At this time a scheme was proposed for obtaining water from the district near Farnham, of an area of thirty-five square miles. The supply was shown to be over-estimated. In another part of the Report the difficulties in the way of a soft-water supply are discussed,—1st. The question of storage and putrefaction, which might be overcome. 2nd. Discoloration from iron pipes. 3rd. Danger of lead solution. But it is noted that at Glasgow lead-pipes and cisterns are used with a constant supply "without any *apprehension* of lead poisoning." Sulphates did not seem to protect from lead solution, chlorides favoured it, carbonate of lime seemed very protective, and carbonic acid even more so. One-57th of a grain of lead per gallon only was left by exposure of water, which contained six grains of the oxide, to the air for twenty-four hours. Pure water became highly poisonous; with carbonic acid in solution the water

remained safe. Organic matter in soft water is doubly dangerous. Dr. Smith, of Aberdeen, considered less than $\frac{1}{20}$th gr. of lead harmless; minimum evil results follow from between $\frac{1}{10}$th to $\frac{1}{20}$th gr. per gallon; but mostly when soft water was used with the consequent ill effects, leaden *cisterns* were not used. In conclusion, these gentlemen enumerate as the properties to be preferred in the water for the supply of the metropolis—1st. Freedom from putrescible organic matter. 2nd. Freedom from discoloration, constant or not. 3rd. Softness and coolness; for these reasons the chalk strata supplies were recommended, as being inexhaustible with all recommendations except the third, which, being temporary, may be removed, "and the superiority of the spring over the river water is most apparent."

We propose treating of these matters as concerns the present and future—showing what has been done, and what remains to be done, whether any of these statements now apply, and what additional reasons and remedies bear now on the question.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

Note on the Crystallisation of Glycerin, by William Crookes, *F.R.S.*

My attention has been drawn by my friend Dr. W. S. Squire, of the firm of Burgoyne, Burbidges and Squire, Coleman Street, to the hitherto unobserved fact of the crystallisation of large masses of glycerin during the recent cold weather.

About five tons of glycerin, in casks of eight cwt. each, were recently imported by this firm from Germany. When they left the factory the contents were in their usual state of viscid fluidity; but, on arriving in London, they were found to have solidified to a solid mass of crystals, so hard that it required a hammer and chisel to break it up.

A large block of this solid glycerin, weighing several hundredweight, suspended in a somewhat warm room, took two or three days to liquify, and a thermometer inserted in the fusing mass indicated a constant temperature of 45° F. In small quantities the crystals rapidly fuse when the bottle containing them is placed in warm water. The original glycerin was pale brown; the crystals formed from it are nearly white, whilst the liquid which drains away from it is dark brown. In quantity, the solid glycerin looks very like a mass of sugar candy. The isolated crystals are sometimes as large as a small pea; they are brilliant, and highly refracting, when rubbed between the fingers they are very hard, and they grate between the teeth. Their form appears to be octahedral, but this is difficult to ascertain accurately, owing to the viscidity of the mother liquor which adheres to them.

The crystals, separated as much as possible from the mother liquor, and then fused by heat, form a clear and nearly colourless liquid, slightly more viscid than usual, which, as far as I have been able to ascertain, possesses all the physical and chemical properties of pure glycerin. It is perfectly miscible with water and alcohol. It has been especially tested for sugar and glucose (common adulterants) with negative results; lead is also absent, and nitrate of silver only produces slight turbidity in its aqueous solution. I believe it to be almost chemically pure anhydrous glycerin.

Some of the fused crystals have been exposed for several hours to a temperature of 0° F. without solidification taking place. The only result was that the liquid became more viscid.

The cause of the crystallisation is not very clear. The most probable explanation is that the vibration of the railway journey across Germany, added to the intense cold to which the glycerin was simultaneously subjected, enabled the particles to arrange themselves in a regular form. The phenomenon then becomes analogous to the crystallisation of wrought iron under the influence of vibration, the gradual solidification of syrupy solutions of organic alkaloids, and the familiar crystallisation of refractory platinum salts in a watch-glass by judicious friction with a stirring rod. Experiments are about to be tried to see if the crystallisation of glycerin can be determined by exposing it to a low temperature, and at the same time setting the particles in a state of vibration.

Should the above view of the cause of this curious phenomenon be correct, we may imagine that, during the railway transit, the vibratory movement was determining at the same time the crystallisation of the glycerin and the railway axles, the rapidity of the action being in the inverse ratio of the viscidity of the two bodies.

On the Preparation of Pure Silver, by Professor* J. S. Stas.

I have had recourse to two distinct methods to procure the pure silver necessary for the different purposes treated of in my investigations.

First Method.—To carry out the first method, I dissolved at the boiling point 3500 grammes of French silver coin in very dilute nitric acid. The nitrate of silver produced, after having been evaporated to dryness and fused, was kept at its point of fusion as long as oxygen compounds of nitrogen were given off. The nitrate mixed with nitrite was dissolved when cool in the smallest possible quantity of cold water, and the solution, after resting forty-eight hours, was filtered through a double filter to separate all the matter that might have remained in suspension. The limpid solution, diluted with thirty times its volume of filtered rain-water, was precipitated by an excess of pure hydrochloric acid. The chloride of silver formed was, when deposited, washed by decantation, first with water acidulated by hydrochloric acid, and then with pure water. This washing was performed by shaking the chloride violently each time in large stoppered bottles with the necessary quantity of liquid.

It was then spread upon a cloth that had been washed with hydrochloric acid, strongly compressed, and left to dry spontaneously. When perfectly dry it was finely powdered and digested for several days in aqua regia. It was then again washed in distilled water.

As the reduction by heat of chloride of silver with carbonate of sodium is a most delicate operation when performed upon large quantities, I made this reduction at a low temperature under the influence of a solution of caustic potash and sugar of milk, as first proposed by Levol.

To procure potash and sugar of milk free from heavy metals, I added to a concentrated solution of hydrate of potassium, previously boiled, a slight excess of a solution

* Abstract from *Memoirs of the Royal Belgian Academy.*

of sulphhydrate of potassium to precipitate traces of dissolved metals. After the deposit of the metallic sulphides, I decanted the alkaline solution and put it in contact with freshly precipitated oxide of silver to deprive it of the sulphhydrate of potassium. After a sufficient digestion and rest, I separated the excess of oxide of silver and the sulphide of silver that had been produced.

By the same means I eliminated the heavy metals contained in an aqueous solution of sugar of milk.

The chloride of silver, distributed in three large porcelain jars, was digested at a temperature of from 70° to 80° C., with the mixture of solutions of hydrate of potassium and sugar of milk, until all the chlorine was separated from the silver. The metallic silver, which was grey, was washed with water until the excess of alkali had disappeared, then digested with dilute pure sulphuric acid, and lastly washed with ammoniacal water. After being dried, 5 per cent. of its weight of calcined borax was added, containing 10 per cent. of nitrate of sodium, and then, with the necessary precautions, it was fused in a "Paris crucible."

The fused metal was then poured into a mould coated with a paste of mixed calcined and non-calcined kaolin. The bars of silver, first cleaned with sharp sand, were then heated to redness with caustic potash from tartar; the adhering kaolin having been dissolved, the bars were washed in pure water.

They were divided into small blocks by means of a chisel of tempered steel. As the hardest chisel leaves traces of iron on the surface of the silver, the small blocks were digested with warm hydrochloric acid, pure and concentrated. The silver was then washed with ammoniacal water, and lastly with water, and heated up to its fusing point before being placed into a well stoppered bottle.

I procured, *at a single casting*, 2875 grammes of silver of an extraordinary whiteness.

I will subsequently state how I assured myself of its state of purity; I wish first to describe the second method which I made use of to procure large quantities of pure silver.

(To be continued.)

On the Nature of the Gas which is given off from Fresh Charcoal when immersed in Water, by William Skey, *Analyst to the Geological Survey, New Zealand.*

(*Concluded from page* 15.)

In contemplating the results of these experiments, the first and most striking circumstance claiming our attention is that charcoal which has already yielded its proper quantity of nitrogen to water can be made to yield quite as much by reigniting it in air and renewing its contact with water; and these processes can be repeated with like effect so long as there is any charcoal remaining. From this, then, it would appear the gas is not derived from the charcoal in the first instance, but from the air. This view receives complete confirmation from the result of the ignition of charcoal in salt; for in this case, air being excluded from the incandescent charcoal, there was no evolution of gas when it was placed in contact with water. It is therefore certain that charcoal has the capacity of retaining nitrogen gas to itself in certain quantities at high as well as at low temperatures, as De Saussure has shown.

Leaving, for the present, the discussion of the manner in which nitrogen is retained by the charcoal, it is next seen that, as with gases absorbed by charcoal at low or ordinary temperatures, the gas which has attached itself to charcoal at high temperatures is also wholly or partly liberated by water, by which, indeed, alone the fact of its retention could well be discovered.

Now, the only other simple liquid which as yet I have found to have this effect upon charcoal is bisulphide of carbon. The oils have no such effect. The capability of such fluids as alcohol, ether, &c., to cause the evolution of gas described is no doubt due to the water they severally contain.

But by a reference to the experiments with concentrated sulphuric acid and solution of hydrate of potash and chloride of calcium, it will be seen that even water has not always these effects upon charcoal. When held in the bonds of powerful affinities it utterly fails to produce them.

The liberation of the gas retained at high temperature by charcoal being thus only effected by certain liquids would appear to show most conclusively that such liberation of gas is not due to a mere mechanical displacement of the gas by the water, but rather that it is due to the exercise of chemical forces.

What part the water or the bisulphide of carbon really plays in these effects they produce, however, does not yet appear. Whether, as substitute for the gas evolved, they are transferred bodily to the charcoal without decomposition, or as an effect of selective affinity, or whether they are decomposed and their constituents combined separately with different portions of the charcoal—which of these reactions, if either, really obtain, is difficult to determine. But taking the case of water, and considering the limited amount of combustible gases supplied to the interior of the charcoal during ignition, the last supposition appears the most probable, since under these circumstances it is almost certain that compounds have been formed of the elements of the ignited mass, which possess such powerful and unsatisfied affinities for oxygen and hydrogen that their sum is equal to what is required for the decomposition of a portion of the water employed.

The manner in which this gas is retained to the charcoal now remains to be considered.

In the first place, it may be retained mechanically or chemically; that it is the latter appears the most probable, since, according to De Saussure, gases absorbed to charcoal by "mechanical absorption are expelled by the accession of heat."

Assuming, then, it to be retained to the charcoal in obedience to chemical affinities, we have finally to consider what is the composition of the chemical compound which the nitrogen gas contributes to form.

Two views of the composition of this hypothetical body here suggest themselves, one of which is, that it is a simple binary compound of the nitrogen with the carbon of the charcoal; the other, that it is a complex compound of nitrogen with two or more of the constituents of the charcoal, one of which is carbon.

From a hasty view, the first of these views might appear the nearest the truth, but I would submit that to adjudge these questions properly requires an enlargement of our knowledge respecting the real nature of charcoal itself.

With regard, indeed, to its chemical composition, this is pretty well known, but this knowledge we have hardly used to its legitimate purpose. Thus, though well aware how pertinaciously the gases oxygen, hydrogen, and nitrogen cling to charcoal, we are in the habit of using

the word "charcoal" as a mere synonym for impure carbon, when it is obvious that at least a portion of the carbon of the charcoal must be in chemical combination with these gases, since we know of no combination among oxygen, hydrogen, and nitrogen of such permanence as to be capable of resisting a degree of temperature approaching to that at which charcoal is made.

Thus leaving the earthy salts present in the charcoal out of the question, we are constrained to admit of the presence of a carbonaceous compound in what is considered a variety of impure carbon; but the question here arises, if a portion of the carbon is thus taken up by these gases, why may not the whole of it, since there must be a most intimate mixture of these several elements with each other, and beside a tendency among the residual constituents of the organic matters operated upon, to arrange themselves in the most permanent forms, and this will of course be the most surely effected by employing the whole of the carbon in this manner.

If this view is correct, it will follow that what is so often referred to as an allotropic variety of carbon is in reality a carbonaceous compound, or more probably a series of such, there being not a particle of free carbon present in it, and therefore the question raised as to whether the nitrogen retained to it at a high temperature is combined with carbon alone or with carbon and one or more elements in addition, receives an answer in favour of the latter hypothesis. It only remains then now to briefly consider what is the probable nature of this complex compound here supposed to exist.

Now, one of the known effects of heat upon organic substances of the nature of wood-coal is to remould their elements, or a portion of their several elements, into acid, basic, or neutral volatile compounds; these latter greatly predominate; but, with very good reason, they are generally supposed to be compounded of the two former, and they are therefore viewed as resolvable bodies.

If, then, those portions which are capable of being volatilised have such a tendency to combine together in certain definite chemical forms we call acid and basic, why may not the fixed or residual portions have similar tendencies equally with the former? The elements of this residual portion have been liberated from combinations built up, under the influence of vital force, to reunite themselves, as has been shown, in chemical union; and, what is more likely than that, with a regard to those general laws which regulate the combination of the elements with each other, they should seek to arrange themselves under each of the two great natural divisions which these laws are constantly striving to enforce, so as to present us with a compound or compounds consisting of both acid and basic substances—in exact equipoise, to form a neutral salt or a series of neutral salts, designated collectively under the unscientific and ill-fitting appellative, charcoal?

The distinguishing feature between these hypothetical bodies would most probably be the presence of nitrogen in those of them playing the parts of bases, and in those only; while a maximum proportion of the oxygen present would be found in those portions possessed of the opposite characters.

The whole of the nitrogen, therefore, present in the charcoal, that originally existing in the wood whence the charcoal is derived as an organic compound, and that absorbed by the charcoal from the air under the influence of heat, I would assume to exist as a constituent portion of these basic compounds; but with this difference, that while the nitrogen derived from the wood itself helps to form a stable compound in presence of water, the nitrogen chemically absorbed from the air is employed to form a very unstable one in presence of the same liquid.

In conclusion, it should be stated that the capacity of charcoal to absorb weak acids and bases, and certain so-called neutral substances, would seem to support to no small extent the views of the constitution of this body here advocated; while, at the same time, the necessity for assuming such a force as mechanical absorption to account for this phenomena (of absorption) is removed, if such a constitution of charcoal is once admitted in theory; for it is almost certain that if charcoal indeed is a mixture of carbonaceous salts, either portion thereof, the acid or basic, will be as insoluble in water as the combination of the two. And because of this insolubility their affinities will be feeble even for each other; it follows, therefore, when other substances are presented thereto, possessing superior basic or acid properties, and free to act, they attach themselves by chemical force unto a portion or the whole of the carbonaceous acids or bases of which the charcoal presumedly consists. To form compounds partaking of the insolubility of these carbonaceous portions, and where these are not volatile, therefore they can only be removed from the charcoal by the application of others possessed of more powerful affinities for them than is exercised by the carbonaceous portion of the new salt.

Indeed, the arguments in favour of admitting a constitution to charcoal such as is here advocated, should properly have been made to rest for their chief support upon its behaviour to weak acids and bases in aqueous solutions; but to avoid going an undue length, I have chosen the present course, although the material for it is all brought together. In case, however, these views receive any favour, I shall make use of it in a further communication.

It has been more lately ascertained that the coke of lignite, or brown coal, when cooled down from a red heat under mercury, yields about one quarter more of nitrogen gas for the same volume than wood charcoal under similar circumstances; the coke of non-hydrous or bituminous coal yields considerably less; while, in the case of recently-ignited bone-charcoal, graphite, the yield of gas to water is at a minimum, though still it is sufficient to enable us to test the amount.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, January 15, 1867.

M. Ch. Mene, gold medallist of the Imperial Society of Sciences, Agriculture, and Useful Arts of Lille, has written a memoir on analyses of cheese. The method consists in ascertaining the density of the cheese, and discovering if there be any reaction—acid, alkaline, or neutral. He then finds, by desiccation, the weight of the water it contains, the proportion of casein, the fatty matters, and determines the different fatty acids which compose them. If there are other organic acids present, he seeks to find out their nature and proportions. Lastly, incineration gives him the weight of the ashes, the mineral salts which the cheese contains, and he terminates the analysis by determining the nature and weight of the acids and bases which form these salts. I forgot to say that, by a special determination of the proportions, he finds the weight of the nitrogen in the cheese. This is an important element of the analysis. If this long series of analyses were to be resumed in a few words, we would say that quantities of water are found in cheeses varying from 20 per cent., which the Parmesan and Roquefort contain, up

to 78 per cent., which correspond to fresh cheeses. The Marolles and Poitiers cheeses have nearly the half of their weight of casein. It is almost totally absent from the cream sold in Paris under the name of cheese. The fatty matters of butter are abundant in these latter. Dutch cheese contains 35 per cent., and white cheese 8 per cent. of casein.

It is the dry cheeses—the Dutch, the Parmesan, &c.—which contain the greatest relative proportion of ashes; the fresh cheeses give less. If we would seek to know what gives so marked a taste and odour to certain cheeses, it will be found that it is occasioned by the butyric, lactic, and valerianic acids united to the ammoniacal salts.

Aliments rich in nitrogen are considered as possessing nutritive qualities in the highest degree; and far before bread or meat, we find the Dutch, Gruyère, and Roquefort cheeses. They contain from 26 to 40 per cent. of nitrogenised matters; meat only contains 22 per cent. Of course, if we consider the aliments from a respiratory point of view, cheese can only introduce combustible elements into the body by means of the fatty matters it contains. In this property it yields only to butter and fatty substances properly so called. If mineral substances be the object sought, we must again have recourse to cheese, which contains 7 to 8 per cent. of ashes, whereas meat and bread only contain 1 per cent. A last term of comparison remains—viz., the flavour and the aroma, its exciting properties. But here chemical analysis is of no use whatever; no one contests these qualities inherent in cheese. On this point we may invoke the unanimous consent, not of numbers, but of all *gastronomes*.

After a great number of fruitless trials to ascertain the proportion of nitrogen in commercial organic matters, such as manures, with recipients filled with soda-lime, M. Mène came to the determination of employing earthenware retorts, analogous to those with which oxygen is obtained from the peroxide of manganese heated to a dull red. He fills them with fragments of caustic potash, in the midst of which he introduces the matter imbued with caustic soda, and formed into balls. He then heats them by commencing the fire at the top. To the tube of the retort he places an apparatus of glass, plunging into diluted hydrochloric acid, so as to absorb the ammoniacal gas, which is evolved by the reaction of the potash on the organic matter. The temperature may be raised to an incipient cherry-red without fear of seeing the retort melt by the action of the potash, and the organic matter is then perfectly destroyed. There is no fear of the destruction of the nitrogenised matters by the action exerted by the potash to convert them into ammoniacal gas,* for direct experiments on special matters, such as albumen, casein, &c., have given in nitrogen exactly (or rather *more* than *less*) the numbers indicated by certain authors, and consequently there can be no doubt on this ground. The determination of the nitrogen, with this modification of the ordinary apparatus, is obtained by the process of Messrs. Will and Varrentrapp—that is, by precipitating the ammoniacal salt by chloride of platinum and calcining it, so as to obtain the weight of the platinum, from which the nitrogen is calculated. By the aid of the modifications which he here indicates in order to obtain the proportion of nitrogen in commercial products, such as manures—that is to say, operating on a large quantity of matter—he here remarks that many figures admitted for certain products as holders of nitrogen should certainly be corrected.

M. Fremy has just published, through Gauthier-Villars, a small pamphlet in quarto, which in the highest degree deserves the attention of the public. We refrain from reproducing any of it, so as not to injure its sale (the price is 50 centimes, or 5d.), made for the profit of the Society of the Friends of Science; but we announce the aim of M. Fremy. He asks the creation of *sixty places*, to be given to persons who cultivate with most distinction the mathematical, physical, and natural sciences, with the mission of advancing science by their labours. They would be divided into three classes, with salaries of 80*l*., 160*l*., and 240*l*. When, in a few months' time, strangers, attracted towards us by the Exhibition, come to tell us of their magnificent laboratories, which, as those of Germany, have often cost several millions of francs, we can say to them, France has better still; she possesses an admirable institution, the aim of which is to provide for all those who follow a scientific career with success.

We are glad to hear that M. H. Schmidt-Missler's products of the pine tree, forest wool and other substances, are at present in active industrial development in Paris. Let us enumerate them rapidly. *Vegetable Wadding:* This preparation preserves all the properties of the pine; it evolves an aroma eminently wholesome. Dr. Schillbach recommends it as a most harmless, but efficacious remedy in cases of catarrh, bronchitis, asthma, sore throat, &c., &c. *Raw Vegetable Wool:* One-half cheaper than the ordinary wool mattrasses. Those stuffed with this wool do not attract humidity; its odour and the ozone due to its resinous principles keep off or kill the insects. *Schmidt-Missler Flannel.*—By reason of the resin, the tannin, and the formic acid it contains, it aids the exercise of the important functions of respiration, absorption, and perspiration, in a greater degree than ordinary flannel. It is at the same time a preservative and corrective agent which merits to become popular in Europe as it is in Germany, and can be woven into any of the forms for which flannel is used, such as mittens, waistcoats, drawers, socks, &c. *Etherated Pine Oil.*—Employed in friction, it has given unexpected results; in the first commencement of paralysis and apoplexy, in the case of recent burns, &c. Some German doctors recommend a few drops in sugar and water to be administered internally as a remedy against cramps in the stomach, worms in children, neuralgia, dropsy, &c. There are also the *Solid Extract of Leaves of the Maritime Pine, the Pine Spirit, and Pine Soap.* All these different products are a most simple but very valuable acquisition. In the *Cosmos* of August 15, 1852, we had called attention to the first of the two establishments founded in Silesia, in the Prairie de Humboldt, by an ancient inspector of forests, M. Pannewitz, for obtaining various products, similar to those above enumerated, from the leaves of the pine tree.

A meteorite fell at Kniahynia, comitat of Unghvar (Hungary), from a perfectly serene sky, on June 9, 1866, between four and five o'clock in the afternoon. A violent detonation similar to that which would be produced by the simultaneous discharge of a hundred cannons, accompanied its appearance, which took place under the form of a grey cloud ten times as large as the apparent disc of the sun, and uniting on all sides columns of greyish smoke, without any vestige of luminous appearance. Two or three minutes afterwards a noise was heard like that of a multitude of stones rattling together and lasting ten or fifteen minutes; after that the fall of stones took place. Several eye witnesses at localities six to twelve Austrian miles (the mile = 7½ kilometres), and especially those to the west of Epuriès (twelve miles to the west of the point where the fall took place), describe the meteor as having presented the appearance of a yellow and orange luminous globe, followed by a train bordered with ultramarine blue. About sixty stones were picked up; they were of the general structure of bodies of this class, and covered, as usual, with a coating of black enamel. The heaviest weighed 550 lbs.; it was broken in two by the violence of the shock, and fell in a field, where it penetrated the earth to the depth of eleven feet (Viennese), leaving a hole more than four feet in diameter. Their density at 20° R. is 3·520. They were quite hot when first obtained, and kept their heat for hours, some for days.

Mr. Toselli, 236, Faubourg Saint-Martin, has made a

* It is well understood that oxygenatod nitro-compounds cannot be analysed for nitrogen by this process.

new ice-making machine on wheels. When Mr. Toselli produced, in 1862, his Italian ice-making apparatus which acts by the cold produced by the mixture of two deliquescent salts, two kilogrammes of salt were obliged to be employed, at the cost of 2 fr., in order to obtain on an average 300 grammes of ice; so that when the idea was given up of recrystallising the salt by evaporation, the kilogramme of artificial ice cost 25 fr. Substituting for the salts employed up to that period a mixture composed of one part water, one of sub-carbonate of soda, and one of nitrate of ammonia, salts which he sold at 1 fr. the kilogramme, and which by their solution produced a cold of 29° C. below zero, Mr. Toselli reduced the cost of artificial ice from 25 fr. to 2 fr. 50 c.; and his small ice-making machines enable us to obtain without difficulty, at a cost of less than 1 fr., 400 grammes of ice very pure and clear, or iced sherbets for five or six persons. The success of this machine and the salts was so great that, in 1864, he sold 20 tons of salts, and in 1866, a cold and damp year, nearly the same quantity. He made, at the commencement of this year, a curious and important observation which opened a new field for him. If, instead of adding to the water at the same time the carbonate of soda and the nitrate of ammonia, the dissolving of which produces a cold of 29° C., the subcarbonate of soda alone is first dissolved in the water, then, ten or twenty minutes afterwards, the nitrate of ammonia is added, the cold produced descends to 34° C. below zero—*i.e.*, more intense by 5°—a very considerable difference, which physicists must account for. This theoretical discovery soon afterwards became a practical one; for this method of operating, the previous dissolving of the salt of soda, has enabled the inventor to substitute for the nitrate of ammonia—a salt rather rare and dear—another salt, more common, which gives, however, a cold of 28° below zero, and enables him to obtain ice, at once, wherever the temperature of the water does not exceed 25° C.

At present Mr. Toselli has for sale, all prepared and put in a box, for the price of 50 centimes (5d.), a new refrigerating mixture, which gives the same quantity of ice as the former mixtures costing 8 fr. This is, as may well be seen, an immense progress in the production of an object of almost prime necessity. After having lowered in such an enormous proportion the prices of the substances producing the cold, it became necessary to simplify the instrument or ice-making machine; thus, the last model made by M. Toselli, called by him the "*glacier roulante*," has exceeded all expectations. It is a simple metallic cylinder mounted on a foot. The salt of soda and the salt of ammonia are added in two operations, as we have before stated, the smaller cylinder containing the water to be frozen is introduced into the interior, and the orifice is closed by an indiarubber disc, and then by a cover fastened with a catch; the cylinder is then placed in a sac, or case of cloth, and it is made to roll on the table with a slight oscillatory movement given by the hand. After a lapse of ten minutes the water in the interior of the cylinder becomes a beautiful cylinder of ice. Nothing is more simple, more economical, or more efficacious than the new "*glacier roulante*," which costs 10 fr., and gives us, moreover, what could not hitherto be obtained with an apparatus containing freezing mixtures—the means of freezing a decanter of water or a bottle of champagne. The apparatus in a case, packed for travelling, with 20 kilogrammes of refrigerating materials and a measure, costs, at present, only 1*l.* It is incredibly cheap.

F. Moigno.

A Chemist in Trouble.—We read in Monday's *Times* that "a lecturer on chemistry, botany, and other branches of natural philosophy," was arrested as a Fenian at Portland Row, Dublin, on the 12th inst.

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, December 26, 1866.

Edward Schunck, *Ph.D., F.R.S., President, in the Chair.*

Mr. Peter Hart exhibited a piece of lead pipe from the Ardwick Bridge Chemical Works, coated internally with oxide of manganese. The pipe was one inch in diameter, and the thickness of the coating of oxide of manganese was about a quarter of an inch. The oxide has not been minutely examined, but it consists no doubt largely if not wholly of the hydrated peroxide, as it evolves chlorine in quantity when gently heated with hydrochloric acid. The water used in the works is collected in tunnels cut in the red sandstone, and there is no doubt that the source of the manganese is the refuse chloride from the chlorine stills situated almost immediately over one of the tunnels. A portion of this chloride, having filtered through the sandstone, has come into contact with the bicarbonate of lime in the water, chloride of calcium and carbonate of manganese have resulted, which latter body, by after contact with oxygen, has become wholly or partially converted into peroxide.

"On some recent observations on the Specific Gravity of Sea Water," by Thomas Heelis, F.R.A.S.

The author had in the course of several long voyages accumulated a number of observations on this subject, all of which were made at sea with the hydrometer. On coming to examine and reduce his results, he had referred to a paper by the late Professor Forchammer, of Copenhagen, published in the Philosophical Transactions. The results arrived at by the Professor differed so much from those obtained by the author that a careful examination of the Professor's paper became necessary before any progress could be made in the reduction of the author's observations, as, if the results of the Professor were correct, the observations must involve such errors that their reduction would be useless. The examination was therefore undertaken, and was extended to the results of the American observations, which are shown in a curve given among the plates to Maury's Physical Geography of the Sea (ninth edition). The American observations were found to accord with those of the author and to differ from the results obtained by the Professor to an extent in some cases of one per cent. of the total salinity. The apparent cause of the discrepancy seemed to be the length of time during which some of the Professor's specimens were kept before being subjected to analysis, the paper in the Philosophical Transactions showing that in one case at least this interval amounted to some twenty years. A further examination of the paper showed, as the author conceived, great errors in arrangement, and especially in the determination of the areas, all the water taken in which was assumed to be from the same region, and all the results of which specimens were included in a common average. There was a strange deficiency in the observations for certain regions, but the boundary lines of the areas were so arranged that the Gulf Stream was included in three regions, the L'Agulhas current in two, and the Equatorial current in two at least; so that if the results had not been drawn from too few specimens, the effect of the high specific gravity of these currents would have been entirely masked by the observations of other water not the subject of current, but included in the averages as belonging to the same regions. As it was, the same result—viz., the disappearance of the effect on the average of each region of the high specific gravity of the waters of these currents was found to occur because of the small number of observations in the currents, there being only one, for instance, of the L'Agulhas current, and this one being masked in the average of the Indian Ocean region,

the specific gravity of part of which, as is well known, is reduced by the fresh water of the large Asiatic rivers.

PHOTOGRAPHICAL SECTION.

December 13, 1866.

J. BARNDELL, *F.R.A.S., Vice-President of the Section, in the Chair.*

Mr. COOTE exhibited a frame for printing transparencies on glass, of which the following is a description :—

As frames for printing transparencies for the lantern and stereoscope have occupied some little attention of late, in the *British Journal of Photography*, I thought it might be useful to submit to the inspection of the meeting to-night one that I had made last winter for printing stereo-transparencies from negatives, on plates 7¼ in. by 4½ in., the size I always use on account of being able to take single pictures in the same camera. The frame is the same in principle as the usual frame for printing transparencies by superposition, and without having to cut either negative or print by simply moving the prepared plate and negative to the right and left in opposite directions alternately; but it is a little longer, and 4¼ in. broad inside. The opening for exposure is in the centre, but is made longer than is required for a stereo print. Over this opening I place a mat made of thin brass, the desired size and shape of the picture required. This mat is sunk into the bed of the frame until it is quite level with it. A negative is then put in, and by moving the mat up or down in its recessed bed, you can get more sky or foreground at will, and the movement right and left gives you any other portion of the picture you may desire. Having settled that point, I then place on the negative a *straight* strip of soft cardboard, wide enough to reach, within about an eighth of an inch, the bottom of the opening in the mat; and then place on the prepared plate, which is kept in a horizontal position by resting on the strip of cardboard; and it also enables you to get the two sides of the picture exactly on a level with each other after reversing, to close the frame. A loose back, with a brass spring on, is put in, and a small lever bar brought down over the spring and held in its position by a small catch. It is necessary to have several strips of cardboard, varying in width, and it will be obvious to any one that they must not exceed in thickness the glass of the prepared plates, otherwise the pressure of the back is kept off the glass and the plates are not in close contact.

By use of this frame I can easily take out for the lantern portions of pictures taken the full size of the plate, say 7¼ in. by 4¼ in., whether the subjects be horizontal or upright.

Mr. DANCER then exhibited, by means of the oxy-hydrogen lantern, a very beautiful series of views by Mr. Buxton, representing scenes in Scotland, Egypt, India, &c., and also views in Derbyshire, Cheshire, and other places, by Mr. Coote and Mr. Brothers.

ACADEMY OF SCIENCES.

December 24, 1866.

"*On the Inverse Consecutive Changes of Volume attending the Formation of Ammoniacal and Alkaline Salts in Water*," by M. J. Regnault.

"*On the Absorption of Hydrogen and Carbonic Oxide by Melted Copper*," by M. Caron. Copper of good quality, weighing about 200 grains, is melted in a boat in a porcelain tube, and hydrogen passed over it, the apparatus being so arranged that the copper could be seen during the whole operation. As soon as the metal fused, it appeared to intumesce, and water was condensed on the cool part of the apparatus. When the oxide which the copper contains is completely reduced, the surface of the metal is as brilliant and mobile as that of mercury. On cooling, a little before solidification, the mirror-like surface becomes agitated and appears to boil up, the escaping gas projecting a multitude of fine drops of copper. The metal then swells, and the solidification terminates by a final incomplete eruption. The ingot of metal, after cooling, is found to be porous. Exactly the same phenomena takes place when the hydrogen is replaced by carbonic oxide.

"*On Protoxide of Nitrogen as an Anæsthetic Agent*," by M. Preterre.

December 31, 1866.

"*On Vital Resistance*," by M. F. A. Pouchet.

"*On the same subject*," by M. Pasteur. These two notes contain additional arguments on the subject of spontaneous generation.

"*On the Argentous and Argentic Hydrates*," by M. P. Weltzien. When a plate of very clean silver is introduced into a neutral solution of peroxide of hydrogen, it becomes covered with bubbles of oxygen, part dissolving with a substitution value of $Ag_2 = 216 = H$. The plate of silver becomes coated with a greyish white film, and then a small quantity of greyish blue powder is precipitated. The solution darkens in the air, taking a reddish brown tint, and becoming slightly turbid from the separation of finely divided silver. When the hydrated argentous solution is evaporated, a colorless crystalline substance is left, which, treated with water, dissolves, leaving silver. The filtrate contains argentic hydrate ($Ag = 108 = H$) and has a feeble alkaline reaction. With hydrochloric acid it gives a precipitate of chloride of silver. Argentous hydrate in solution gives, with potash, a brown black precipitate (argentous oxide). With hydrochloric acid it forms, after a certain time, a precipitate of chloride of silver and metal. These reactions may be expressed by the following equations :—

$$2Ag_2 + H_2O_2 = 2HAg_2O.$$

(Argentous hydrate)

$$2HAg_2O = 2HAgO = 2HAgO + Ag_2.$$

(Argentic hydrate.)

$$2HAg_2O + 2HCl = 2H_2O + 2AgCl + Ag_2.$$

The solution of argentous hydrate is not precipitated by sulphuretted hydrogen. On evaporation metallic silver separates. When oxide of silver is added to oxy-water, it is known that the oxide is reduced with a brisk disengagement of oxygen; at the same time argentous hydrate is formed by the action of peroxide of hydrogen on the finely divided silver. The author is engaged in the examination of the grey coating which forms on the silver; he believes it to be peroxide of siver.

"*On the Existence of an Amyloid Matter in the Yolk of Egg*," by M. Camille Dareste. The author finds that in the yolk of egg there exists a considerable quantity of microscopic granules which become coloured blue under the influence of iodine, and whose form and structure exactly recall those of starch. Their size varies greatly; ordinarily they are very small, but some are met with as large as the largest granules of wheat starch. On these, concentric layers and a central nucleus are seen; these granules are very difficult to recognise.

"*Experiments on Superheated Steam*," by MM. G. A. Hern and A. Cazin.

"*On Silkworm Disease*," by M. Béchamp.

January 8, 1867.

(FROM OUR OWN CORRESPONDENT.)

M. LEROUX read a paper "*On Luminous Vibrations*," the conclusion of which is that the incident and reflected vibrations are (in direction) the projections of the refracted vibration upon the incident and reflected waves. This is MacCullagh's theorem.

M. de Caligny again calls attention to the means of economising water in the working of locks.

M. Maigne communicates an easy method of deter-

mining the nitrogen of manures in operating on only 50 grammes.

M. Carus, of Dresden, a correspondent, thinks it his duty to call the attention of the Academy to a remarkable case of preservation from cholera during the epidemic of 1866. A whole town had been attacked, and already there had been 119 victims. It was greatly feared that it would spread to a prison containing 1250 inmates, and recourse was had to very simple prophylactic means, but which proved very efficacious:—1st. Every day the excremental matters were disinfected by throwing into them ashes or fragments of lime, or treating them with chlorine or pyrogallic acid. 2nd. The diet of prisoners was improved. 3rd. The wards were disinfected, and the clothing and bedding were so disposed as to prevent any sudden cold. 4th. Each individual was daily submitted to an examination to ascertain the state of his health. 5th. Moral influences of different sorts were exerted to quell any alarm calculated to predispose the body to morbid invasion, &c. Thanks to these precautions, the entire prison was preserved.

M. Becquerel, in his name and that of his son, M. Edmund Becquerel, presented a new series of observations, thermometric and hygrometric, taken simultaneously in free air and under trees, the general results of which may be summed up as follows:—In summer the mean temperature in free air slightly exceeds that under the trees; in winter the contrary is the case. The trees, in spite of their inferior conductibility, assume a temperature in equilibrium with that of the air, but very slowly. The diurnal maximum takes place towards midnight under the trees, whereas it occurs towards 3 o'clock in the afternoon in free air. A little more rain falls three kilometres from the wood than at its verge or in the interior. The climate under the trees is a sort of sea-climate, and this conclusion of the thermometric and hygrometric observations is confirmed by numerous facts of vegetation.

M. Henry St. Claire Deville laid upon the table a note, compiled by him, in connexion with M. Wöhler, "*On a New Alloy of Aluminium and Boron.*"

General Morin read a new note on the immense reservoir, constructed at the expense of the town of Saint-Etienne by M. Krauss, engineer of bridges and roadways, to store up the waters of the Furens and other watercourses which are changed twice a year into torrents. The total capacity of the basin is 528¾ millions of gallons, and as the wants of the town require only 132 millions, there remain at disposal 396¼ millions of pure and wholesome water; at the same time all danger of inundation is avoided. The sum expended by the town is certainly enormous, but the concessions of water bring in 5 per cent. of the money laid out, without counting the considerably increased value of the factories belonging to it.

M. Velpeau calls attention to the "anamo-inamovible" bandages of silicate of potash or soluble glass, which advantageously replaces albumen, starch, dextrin, papier maché, plaster of Paris, &c. The most valuable property of the bandage of soluble glass is that of promptly drying in two or three hours, and of easily becoming soft with water.

M. Balard communicates a new and very important discovery by M. Berthelot,—the synthetic production of oxalic acid by means of superoxygenated acetylin in contact with permanganate of potash. This transformation of acetylin into oxalic acid is easy and prompt, and takes place in rather considerable proportions. As the bi-carburetted hydrogen or common street gas is acetylin *plus* hydrogen, it is also transformed into oxalic acid, but in a less proportion, and mixed with foreign substances. It is truly curious to see these three mineral substances—carbon, hydrogen, and oxygen—arrive, by their successive addition, to produce an organic substance, oxalic acid: carbon + hydrogen = acetylin, acetylin + oxygen = oxalic acid. It is certain that by making permanganate of potash act on carburets analogous to acetylin, amylin, ethylin, &c., we can produce other syntheses not less interesting than oxalic acid.

M. Charles Grad seemed disposed to conclude from the experiments of M. Bertin on ice, and from an attentive study of the glaciers of Mont-Rosa, that we must renounce looking to the viscosity of Mr. Forbes, or to the regelation of Professors Tyndall and Faraday, for the explanation of the movement of glaciers, to revert to the ancient theory of dilation of M. Chapentier.

It may be recollected that M. Desnoyers, librarian to the Museum of Natural History, Paris, and Member of the Academy of Inscriptions and Belles-Lettres, had remarked on a great number of fossil bones, of the strata of Saint Prest, near Chartres, scratched grooves or cuts, which he attributes to the hand of contemporaneous man. He alluded to some on the bones of the *elephas meridionalis*, the *rhinoceros lepthorhinos*, *&c.* Many geologists, M. Bayle among others, of the *Ecole des Mines*, did not see in these marks anything but injuries purely accidental, occasioned by the surrounding pebbles, or the hand which had extracted the bones from the surrounding clay; and they brought as an argument against the interpretation of M. Desnoyers, the fact that in these quarries no ancient remains of human industry had been found. M. Archiac is informed that this objection is at present without foundation, since the Abbé Bourgeois de Pontlevoy, the celebrated collector, has found in the Saint Prest beds shaped flint implements of various forms—hatchets, arrow-heads, &c.

M. Fremy presents, in the name of M. Louis Fiquier, his work—"*l'Année Scientifique et Industrielle, ou Exposé Annuelle des Travaux Scientifiques des Inventions, et des Principales Applications de la Science à l'Industrie et aux Arts que ont Attiré l'Attention Publique en France et en l'Etranger*," a volume in 12mo, of 500 pages, published by Hachette. All we can say is, in echoing the words of M. Fremy, that this volume is in every way equal to its predecessors.

M. Leverrier communicated a letter addressed from Algiers to M. Wolff by a commandant of Artillery on the earthquake of January 3. Five or six shocks were counted, the most violent of which was that which took place at 7h. 13m. It made the extremity of the conical pendulum mounted as a seismometer, or apparatus for indicating earthquake, form an abnormal curve of amplitude of some extent, which M. Leverrier placed before the eyes of the Academy, and which represents very well the successive oscillations of the ground, first north-west, then north, west, east, west, &c.

January 14, 1867.

(From our own Correspondent.)

M. Matteucci informed the Academy of his researches on the adhesion of air to metallic surfaces. He heats plates of platinum in a current of oxygen or hydrogen; then he places them, while yet hot, in closed apparatus containing one of the above-named bodies. Immediately there is a diminution of volume of the gases, and formation of aqueous vapours by the combination of the oxygen and hydrogen. It may happen in this case that (for platinum) the adhesion of the gases is not only to the metallic surface, but also in the interior of the metal itself. Every one, in fact, knows that metallic platinum is generally formed by hammering spongy platinum, a substance which has the property of exciting the combination of a certain number of gases together; hence it will not be unreasonable to believe that the molecular interstices, opened by the heat, would retain the gases, and thus cause their combination under the influence of other bodies in contact with them.

M. Sommet, a pupil of M. Wurtz, on account of the accidents which unfortunately too frequently happen in

coal mines subject to firedamp, proposed to introduce into all the drifts electrical conducting wires, so that, on several points, during the absence of the men, the inflammable gases may be set on fire by interrupting the electrical circuit. By this means, he said, the numerous deaths might be avoided which during the last month have brought desolation into the families of the colliers and the neighbourhood.

M. Linguet addressed to the Academy a long research upon the electric influences relative to atmospheric meteors. He endeavoured to explain all the rains we had during the past year, the hail, thunder, cold, heat, drought, &c., by electrical phenomena, which take place in the atmosphere. Also, he indicates the means of preserving us from these more or less disastrous meteoric phenomena. We regret extremely that M. Chevreul did not say a few words on the means proposed by M. Linguet.

M. Blondeau (of Nancy) sent a memoir relative to the detection of stains of blood upon linen in the case of legal surgery. All persons occupied in legal medicine comprehend the great interest attached to similar labours; for after the linen has been washed the stains resemble very much stains of rust or ironmould, or marks which certain organic acids or vegetable colouring matters would leave. These are the principal characters indicated by the author:—1st. Stains of rust or ironmould are clear and dull; blood stains are of a deeper colour, and shining. 2nd. If heat be applied up to 25 or 30° C. to the suspected object, blood stains will scale off and are easily detached, whereas ironmould remains. 3rd. If the linen be wetted with hydrochloric acid the ironmould is dissolved, while blood stains remain unaltered. In the former the presence of iron is at once indicated, but not so in the latter. 4th. The stains of acid fruits with iron are hygrometric and soluble in water. 5th. The microscope should be employed, in order to recognise directly the globules of blood detached from the linen and dissolved in oil.

Mr. Phipson communicates the results of his analysis of the sands found in Oceania, in the torrents, which are a compound of argil, apatites, calcareous substances, pyrites, titanate of iron, and small particles of *diamond*. It is always found in soil brought down by the waters in the midst of sands which form the bed of rivers. Thus, the memoir of Mr. Phipson confirms the previous information, and proves that in all modern soil brought down by water, search should be made for this precious substance. The analysis showed it to be in the proportion of $\frac{1}{1000}$ of the land.

M. Pelouze presented an important memoir on the manufacture of glass. It is well known that this substance is fabricated by mixing 100 parts of sand, 40 to 45 of sulphate of soda, 80 of powdered charcoal, 6 of slaked lime, and 20 to 50 of old glass broken up, in crucibles or pots, which are submitted to a great heat. The formula of glass is about $CaO(SiO_3)^2 + (NaO)KaO(SiO_3)^2$—that is to say, a bisilicate of lime and potash or soda. M. Pelouze has discovered that if one would wish to change the reciprocal proportions of the bodies which practice and analysis have fixed, new substances are obtained, and he showed, in confirmation of this, some very remarkable specimens. One in which the proportion of silica had been increased to 400, represented the porcelain called *de Reaumier's*—that is to say, an opaque substance, and analogous to the translucent marble called Algerian. The other specimen, in which the proportion of alcali was greater than usual, formed a very attackable glass; if the alumina be increased we obtain a scoriform non-vitrifiable mass. The learned *savant* then made some observations on the presence of sulphur and oxide of iron in materials of the glass. Experiments proved that a small quantity of sulphur gave a green tint, and that if the glass so coloured be heated it becomes yellow; if it be cooled, the sulphate of soda is reduced, and the green colour appears.

M. Pouillet read a report serving as instructions for fixing lightning conductors to powder magazines. The Minister of War, it appears, had great fears that the powder magazines might be set fire to by lightning, and in order to prevent this he asked the Academy for new instructions for establishing preservative apparatus.

NOTICES OF BOOKS.

*Traité Pratique d'Analyse Chimique.** By F. Wöhler, F.R.S., Professor of Chemistry at the University of Göttingen, Foreign Associate of the Institute of France. Paris: Gauthier-Villars.

This little work was originally written for the use of the students at the University of Göttingen, and an English translation of the first German edition was published by Dr. Hofmann 13 years ago. Since that time chemical analysis has undergone such great changes that the present edition may be almost considered a new work. It is a French translation of the latest German edition, by MM. Grandeau and Troost, who have enriched it by several original methods. Dr. Wöhler's work in its present form is adapted not merely for a book of instruction for chemical students, but also for a standard work of reference on chemical analysis, its suitability for this purpose being greatly increased by the alphabetical "analytical table," with which it commences. The preface to the book so clearly expresses its value that we are induced to quote it in full. The author says:—

"I have been guided in my choice of the plan of this work by the conviction that it is easier for most minds to ascend from individual facts to general laws and rules, than to descend from general rules to individual cases. It has, therefore, been my object to write a book that should leave both something for the pupil to reflect upon, and something for the master to explain. I leave to the latter the double care, where he may think it advisable, to point out the names of the inventors of the different methods, and to pronounce upon the relative value of the processes described. The systematic order has not always been followed in the description of the analytical processes, but the tables at the commencement of the work will greatly facilitate reference.

"With respect to the plan and spirit of this treatise, I have nothing to add to the preface of the second German edition I have lately brought out. I will merely say that the French translation is not a simple translation, but a new edition, enlarged and corrected by the labour of my two learned friends, MM. Grandeau and Troost. Theirs is the merit of having given it, by numerous well chosen additions and instructive diagrams, a perfection that the German original is very far from attaining."

We do not propose now to give any further extracts, as we have arranged, through the courtesy of Professor Wöhler, that the novel and beautiful methods of analysis, of which he is so great a master, may be published in detail in the pages of the Chemical News.

We will, therefore, at present only add that the arrangement of the matter is all that could be desired, while the name of the author, who is admitted to be *facile princeps* in minute and accurate mineral analysis, is a sufficient guarantee of the great value of the processes which will now, for the first time, be laid before English chemists.

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3117. C. Crockford, Holywell, Flint., "Improvements

* Translated from Wöhler's "Mineral-Analyse in Beispielen," by MM. Grandeau and Troost.

in the reduction and treatment of zinc ores in the manufacture of spelter, and in the utilisation of the products resulting therefrom, and also in the construction of the furnaces and apparatus employed for such purposes."—Petition recorded Nov. 27, 1866.

3152. W. Clark, Chancery Lane, "Improvements in the manufacture of green colouring matter."—A communication from J. A. Schlumberger, Boulevart St. Martin, Paris.—Nov. 30, 1866.

3189. W. H. Richardson, Glasgow, N.B., "Certain improvements in the manufacture of iron, and in the means employed for effecting the same."—Dec. 4, 1866.

3266. V. Gallet, Lavausseau de Benassais, Vienne, France, "Improvements in the manufacture of steel."—Dec. 12, 1866.

3280. J. Stenson, Duston, Northamptonshire, "Improvements in the manufacture and remelting of iron and steel."—Dec. 13, 1866.

NOTICES TO PROCEED.

2571. G. Gordon, San Francisco, California, "An improved system or process of treating animal charcoal used in the purification of sugar, and also improved apparatus to be employed in such process."—October 6, 1866.

CORRESPONDENCE.

A Miniature Museum.

To the Editor of the CHEMICAL NEWS.

SIR,—Your correspondent, "A Student," who writes in your last number respecting the arrangement of chemical specimens, has introduced a subject which I am sure will interest a large class of chemists. I hope several of your correspondents will be induced to give us the results of their experience, and, as a contribution to the general fund of knowledge, I beg to forward my mite.

I have two or three drawers in my laboratory fitted up as follows:—They are 12 inches wide, 18 inches long, and 4 inches deep. I procured two pieces of perforated zinc with holes about $\frac{3}{4}$-inch diameter and as close together as possible. These were 12 by 18 inches, and were so cut that when laid one on the other the perforations should exactly coincide. One of these pieces was screwed (on small blocks) into the drawer about one inch from the bottom, and the other piece of zinc was fastened in a similar manner one inch from the top, a space of about two inches being between the two zincs. Next I had 18 dozen of glass tubes made, sealed up at one end, a little thicker than test tubes, and having the mouth not turned over, but only just softened in the blowpipe, so as to take off the cutting edge. These were a trifle smaller in diameter than the holes, were $3\frac{1}{4}$ inches long, and being fitted with corks, were placed upright in the holes in the zinc plates. They stood very firmly and in perfect order in 18 rows, 12 in each row. In these I have commenced to arrange my chemical specimens. They are labelled by writing with a fine pen on the corks, a duplicate label being held *in* the tube close to the side by the cork.

This plan has the advantages of occupying very little room and being cheap. In a small drawer I have 216 specimens in perfect order, and the whole expense was under twenty shillings.

I am, &c. ANOTHER STUDENT.

R. C. C., January 14.

Gas from Charcoal—Soluble Vegetable Fibre.

To the Editor of the CHEMICAL NEWS.

SIR,—Mr. William Skey opens a paper, contributed to your last impression, with the words, "As far as I can learn, it is generally supposed that the gas escaping from charcoal when put in contact with water is common air—and, indeed, I am not aware that any different opinions are, or ever have been, entertained."

He cannot know, then, that last year Drs. Blumsritt and Reichardt published an extensive series of researches about the gases absorbed by solid bodies (*Chemisches Centralblatt*, 1866, pp. 689. 705, 753, 769). Their paper has most likely not yet been noticed in English chemical periodicals. The *Journal fur practishe Chemie*, of Sept. 30, 1866, seems to contain the same papers, according to the notice in your "Contemporary Scientific Press" of last week.

Dr. Blumsritt found in one case the gas absorbed by charcoal to consist of pure nitrogen; but in most cases it contained carbonic acid, and sometimes oxygen, though never as much as atmospheric air.

With reference to Mr. Skey's paper in your last impression but one, "On the Effect of Ammoniated Solution of Copper on Vegetable Fibre," he will derive much information on the same subject from the innumerable and exhaustive researches published some seven or eight years ago by MM. Schwerzer, Naegeli, Pelouze, and many other eminent chemists, most of them German or French.

I am, &c. G. L.

South Shields, January 14, 1867.

Ansell's Firedamp Indicator.

To the Editor of the CHEMICAL NEWS.

SIR,—A great mass of correspondance has appeared in the papers upon the subject of Ansell's Indicator. Great injustice has been done to that gentleman in two particulars mainly—First, that Lord Kinnaird's statements about the proper ventilation of certain mines (which may or may not be founded in truth) have been promiscuously involved in the efficiency of a certain instrument; and second, they have attributed a desire on Mr. Ansell's part to enforce compulsory adoption of his indicator in default of the approbation of the instrument by men well versed in the subject and most practically informed in the bearing of all details. The evidence of Mr. Ansell certainly entirely disposes of the second cause of complaint. But a third question remains which I feel more doubt about. Have any results been yet published as to the actual practical working of the instrument? Have any engineers given evidence in its favour? And lastly, is it true that Mr. Ansell acted in a manner to convince the public generally of the value of his instrument, when he met certain objections with the reply that each and every one of them was simply untrue? Again, can a laboratory experiment, more or less theoretical in per centage, &c., replace a practical investigation, where all sources of fallacy are co-operating? A serious charge I also copy: "Mr. Ansell himself has drawn the especial attention of the Select Committee on 'Mines' to the fact that his indicator does not always indicate correctly, with the alarming excuse for the failure of the instrument in the experiment mentioned that 'it was agreed that this was held 10 seconds too long, as the index hand travelled backwards.'" Of course, the objections to the working of the machine rationally show an utter want of comprehension of the instrument. Mr. Ansell can hardly be expected to answer in a rational manner the observations of a writer who talks against insulating wires because they would look like a spider's web, radiating from a common centre (the manager being the spider in the middle); of the tiny poles of the little battery—"of the tinkling of the little bell." The only way to suppose that the author in such words discusses the practical applications of a well thought out scheme is, that such language is used as a cloak to confusion of ideas; or that it is what is now called a prose poem. I am inclined to think that the author of the letter referred to is a poet.

I am, &c.

DON'T BLOW UP.

Iodine in Mineral Phosphates.

To the Editor of the Chemical News.

Sir,—In reference to the occurrence of iodine in phosphorite, I would mention that it seems probable that this element will more frequently be met with in phosphorites if proper search is made for it.

Besides in the phosphorite of Nassau, as cited by your correspondent "F.," iodine has been found in the phosphorite of three localities in Bavaria—namely, in that of Redwitz, Fuehsmühl, near Waldrassen, and Amberg. The latter occurrence is the more important one, and it is the mineral of this locality in which the presence of iodine was first noticed by Alex. Müller and by W. Mayer.

The quantity of iodine in this mineral is so minute that it will escape observation in an ordinary analysis. Its presence is, however, readily rendered visible by placing the powdered mineral, mixed with glass-powder, in a flask, pouring strong sulphuric acid over it, and allowing the whole to stand for some time, when violet vapours of more or less intensity will make their appearance. As phosphorites from various localities are so often subjected to analysis, it would be a matter of interest if chemists would avail themselves of the opportunity, and make the additional simple experiment for the purpose of ascertaining the presence of iodine.

I am, &c. H. M.

Arrangement of Chemical Specimens.

To the Editor of the Chemical News.

Sir,—"Student" asks how best to arrange chemical specimens. I have devoted some attention to this subject for many years, having had the arrangement and curatorship of a tolerably extensive chemical museum. As the result of my experience, I would strongly advise that the classification should be strictly that followed in Gmelin's chemistry. It may be arbitrary, but I know of no other which so clearly and absolutely defines in a collection the proper position of any chemical compound.

There is only one drawback which I cannot quite get over to my satisfaction—that is, it requires the proximity of bottles of all sizes and shapes, and thus interferes with the neat appearance of the cupboards. This objection is, however, trifling in comparison to the great convenience of the plan of arrangement.

I am, &c. M. P. S.

MISCELLANEOUS.

Poisoning by Sulphuretted Hydrogen.—On Thursday, the 10th inst., Mr. Richards, the deputy-coroner, instituted an inquiry under the following circumstances:—Two men had been ordered by the foreman at the Iceland Chemical Works, Bow, to empty a tank containing sulphate of ammonia. A third workman shortly afterwards found one of them partly in the tank for the purpose of fitting a syphon to draw the liquor off, taking a light down into the tank with him. The other workman was standing on a stage close at hand, when the man who had descended into the tank returned with the light out, and asked to have it relighted; he was asked what put it out, but did not answer. The lamp being relighted another descent into the tank was made by the same workman, who was next seen by the person who found the two men together, to lean his face on his hand, and fell into the liquor in the tank. The deponent Harley, on seeing this, immediately went down the ladder, succeeded in seizing the arms of the suffocated man, but became insensible himself. A clear statement of what followed was not given, but Harley was saved, and the other two men were suffocated by sulphuretted hydrogen gas. It was stated that a similar accident nearly happened to one of the deceased a few weeks previously. The verdict of the jury amounted to an expression of their opinion that the foreman of the works was much to blame. No doubt much obscurity exists in the above case, but enough is learnt to show three things—gross carelessness somewhere, loss of life, and nobody responsible. But it also serves as an antithesis to the late colliery accidents and loss of life, and, like them, shows that the work of supervision in works where many sources of danger are rife, from the largest to the smallest, is utterly bad. The ordinary workman is not to be relied upon; he wants continual supervision, and this is not provided. Thus, in the present case, when warnings of danger had been given, by the flame of the lamp being extinguished by some noxious gas, a descent was still persisted in; so in mines where gas has been known to be accumulating, the flame of the lamp has been exposed by the workmen for the purpose of lighting their pipes, and, if not so bad as this, matches have been carried about for the same purpose. Instances might be multiplied of this carelessness and its evil results. Our object is not so much to state over again what everyone knows, but to show that for the recurrence of such accidents to be prevented, a responsibility must be recognised as belonging to some one person who may be legally punished for a neglect of duty. The public certainly will never tolerate applications of chemical science to manufactures, if all precautions be not taken against such loss of life, whether it be on a large or a small scale.

Decimal Weights and Measures.—The Astronomer-Royal has sent the following to the *Athenæum*:—"In the last week's *Athenæum*, page 9, column 3, I observe the following remarks:—'We should hail a *Permissive* Bill in favour of *allowing* the decimal subdivisions of a mile, a foot, a pound, a gallon, &c., to contracting parties who wish for them.' 'Sir John Herschel is also of opinion that decimals of our present units should be allowed.' I ask leave to make known to the public, through the *Athenæum*, the present state of the British law on this subject. In the 'Act to Render Permissive the Use of the Metric System of Weights and Measures,' 27 and 28 Vic. cap. 117, section 2, is the following provision:—'Notwithstanding anything contained in any Act of Parliament to the contrary, no contract or dealing shall be deemed to be invalid or open to objection on the ground that the weights or measures expressed or referred to in such contract or dealing are weights or measures of the metric system, or on the ground that decimal subdivisions of legal weights and measures, whether metric or otherwise, are used in such contract or dealing.' This appears to contain all that is desired in the *Athenæum*. I greatly doubt whether extensive advantage will be taken of this permission, at least, until we have a decimal coinage. I know of only three instances in which the decimal subdivision is really useful—the decimal division of the foot on surveyors' levelling-staves; the decimal division of the avoirdupois pound in certain operations for tare, by rule-of-three, in the Custom House; and the decimal subdivision of the troy ounce for bullion. In the first two of these, the persons concerned introduced them without waiting for an Act, and in the third they promoted a special Act. In ordinary cases, where there are facilities both for decimal and for binary subdivision, (as the mile of eighty chains, the ton of twenty hundredweight), the decimal subdivision is never used. One of the most curious instances, showing the tendency of mankind to adopt some special weight or measure as the standard for some special goods, and then to subdivide it, not by decimalising, but by successive halving, is that of the stone of fourteen pounds, used throughout Britain as the standard weight for flour, oatmeal, salt, &c. In Scotland it has long since been halved and halved down to the one-sixteenth part, or fourteen ounces, there called the 'meal-pound.' In Lancashire it is halved and halved; and applications have been made by the local authorities to the Exchequer for standards of three and a half pounds."

Copper Smoke.—For generations past efforts have been made to utilise or neutralise the smoke emitted from the various copper works of the kingdom, which is known to be so injurious to all vegetation around. In the neighbourhood of Swansea, which is the principal seat of the copper trade, there are thousands of acres with hardly a blade of grass upon the ground, and in many instances the smelters have had to pay heavy damages for the injurious effects of the smoke on adjoining properties, even trees many miles distant being affected. About twelve months ago Mr. H. H. Vivian, M.P., adopted an invention at his works in order to see whether something could not be done to abate the nuisance, and, if possible, utilise the smoke as well. A considerable outlay was incurred in giving a thorough practical test to the invention, and at the meeting of the West Glamorgan Agricultural Society Mr. Vivian announced that his efforts had been crowned with entire success. The smoke is condensed, and by judicious admixtures a very excellent superphosphate is produced, which is especially suitable for root crops. Mr. Vivian calculates that in a short time he will be able to produce annually sufficient manure for 40,000 acres of land. The success attained will no doubt induce other copper smelters to follow the example, and many thousand acres, which are now almost a barren waste, will then be made fertile ground.—*The Times.* [Our readers scarcely require reminding that "copper smoke" does not make superphosphate of lime; it is merely condensed for the purpose of producing oil of vitriol; the phosphates, bone ash, sombrero, coprolites, &c., have to be purchased in the usual way, and treated with sulphuric acid, the product of which is superphosphate of lime.]

Skeleton Leaves.—"The following method has been communicated to the Botanical Society of Edinburgh:—'A solution of caustic soda is made by dissolving 3 oz. of washing soda in 2 pints of boiling water, and adding 1½ oz. of quicklime, previously slacked; boil for ten minutes, decant the clear solution and bring it to the boil. During ebullition add the leaves; boil briskly for some time—say an hour—occasionally adding hot water to supply the place of that lost by evaporation. Take out a leaf and put it into a vessel of water, rub it between the fingers under the water. If the epidermis and parenchyma separate easily, the rest of the leaves may be removed from the solution, and treated in the same way; but if not, then the boiling must be continued for some time longer. To bleach the skeletons, mix about a drachm of chloride of lime with a pint of water, adding sufficient acetic acid to liberate the chlorine. Steep the leaves in this till they are whitened (about ten minutes), taking care not to let them stay in too long; otherwise they are apt to become brittle. Put them into clean water, and float them out on pieces of paper. Lastly, remove them from the paper before they are quite dry, and place them in a book or botanical press.' Dr. G. Dickson."—*Hardwicke's Science-Gossip.*

A Flash of Lightning.—A *Smatterer* writes:—A stout iron hook, part of a set of block pulleys, snapped while an iron casting weighing near four tons was being lifted. The iron was found defective in texture and in forging. At the moment of breaking a bright flash of light was distinctly seen between the broken fragments. Is this a usual phenomenon? If so, what is its nature, or how accounted for? This occurred in broad daylight, with fine, drizzling rain falling at the time; and the flash was described as from eighteen inches to two feet long.

On the Reactions of Morphine and Narcotine,* by M. Husemann.—M. Husemann's process for distinguishing morphine consists in dissolving the matters to be tested in concentrated sulphuric acid, and adding a drop of nitric acid to the solution. If morphine is present, it immediately produces a coloration varying from rose to the most intense carmine, and by heating for some minutes to 100° or 150°, a magnificent violet colour appears, which afterwards changes to blood-red. Narcotine becomes bluish-green in cold sulphuric acid, turning violet-red by the action of heat.

* *Journ. de Pharmacologie.*

Meetings for the Week.

Tuesday, January 22.

Royal Medical and Chirurgical Society, 8½ p.m.

Ethnological Society, 8 p.m.

Royal Institution, 3 p.m. Professor Tyndall "*On Vibratory Motion.*"

Thursday, January 24.

Royal Society, 8½ p.m.

Royal Institution, 3 p.m. Professor Tyndall, "*On Vibratory Motion.*"

Friday, January 25.

Royal Institution, at 8 p.m. Dr. Odling, F.R.S., "*On Mr. Graham's Recent Discoveries on the Diffusion of Gases.*"

Quekett Microscopical Club, at 8 p.m. Dr. Sedgwick, "*On a Moveable Stand carrying Lamp and Microscope.*" Mr. C. A. Watkins, "*On Yeast and other Ferments.*"

Saturday, January 26.

Royal Institution, at 3 p.m. G. A. Macfarren, Esq., "*On Harmony.*"

ANSWERS TO CORRESPONDENTS.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. 0d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

Tyro.—We presume Dr. Calvert meant that acetylin was the richest *gaseous* hydrocarbon known.

Electric.—Du Moncel's book on the Induction Coil will give you all the information you require. It can be obtained at Asher's.

Steatite.—J. C., who inquired about this article a week or two ago, is informed that several letters giving him the desired information are waiting for him at our office.

G. L.—Chemical Text-book.—The question arrived too late to be answered last week. We are of opinion that Dr. Roscoe's little work on Chemistry, reviewed some months back in our columns, will be as good a one for your purpose as any you can have. We beg to express our obligations to G. L. for his communications.

Erratum.—In the contents of the "Bulletin de la Société Industrielle de Mulhouse," vol. 36, the paper "On the Comparative Solidity of Thickeners composed of Lucine and Albumen," by *J. Roberts* and A. Rosenstiehl, the authors' names should have been "*Robert Wilson Thom* and A. Rosenstiehl." The error, which we hasten to correct, was copied from the Bulletin.

Specific Gravity.—To find the true specific gravity of coke, it should be reduced to the finest possible powder, then weighed in air, and afterwards in water, boiling it well in the water first to be sure that all air is removed. Unless you take these precautions, the specific gravity will be too low from adherent air. A very beautiful piece of apparatus for ascertaining the specific gravity of porous bodies has been devised by Professor Leslie, and is described and illustrated in Faraday's Chemical Manipulations, p. 53.

Blowpipe Analysis.—The woodcuts for this paper have not been finished in time for insertion this week.

Querist.—Fat lute is made by beating dried and finely-pulverised pipeclay with drying linseed oil until the mixture be soft and ductile. It is to be closely applied to the junction intended to be made tight, the glass or other substance being first wiped perfectly dry. Common glaziers' putty resembles this lute, and will in most cases answer the same purpose.

Medico-Legal.—You can obtain the magnesium rods at Mr. How's, Foster Lane. The other chemicals and apparatus you mention can also be procured at the same place.

J. MacVicar.—You will find nothing so good as Condy's *crimson* fluid for removing the fetid odour complained of. The *green* fluid will not answer your purpose so well.

CS_2.—*Extraction of Grease.*—If CS_2 will address E. S., 2, Albert Road, Forest Lane, Stratford, E., information can be given where an apparatus as mentioned can be seen at work.

Books Received.—"Practical Chemistry," by S. Macadam, Ph.D., &c.; Dr. Hunter *v. Pall Mall Gazette:*" "Matter: its Ministry to Life in Health and Disease; and Earth—as the Natural Link between Organic and Inorganic Matter," by Thos. Hawksley, M.D., &c.; "The Elements," Vol. II., by W. Layton Jordan.

Received, with Thanks.—R. Warington, jun.; F. V.

LIME-JUICE AND SCURVY.

A discussion has been going on for some time respecting the value of lime-juice as an antiscorbutic. Chemistry is capable of throwing considerable light on the subject, and we wish to draw attention to one or two points in connexion with it. Dr. Stone, in a letter to *The Times*, says:—

"In the absence of fresh succulent vegetables, lime or lemon-juice must take the foremost place; that it contains something of a specific nature we know—what that something is we have yet to discover; certainly not citric acid, for this, notwithstanding what has been asserted by some writers, is worthless."

Dr. Stone proceeds to say that potash salts stand next to lime-juice in value, and are stated by Dr. Garrod to be the deficient ingredient in the blood of scorbutic persons. This is scarcely stating the case strong enough. It is believed by Baron Liebig and other high authorities that the specific in lime or lemon-juice which "we have yet to discover" is actually the potash which it contains, and examination certainly appears to support this view of the case.

Lime-juice is used in the English navy and merchant service as an efficient antiscorbutic. Amongst American seamen scurvy is almost unknown, and this immunity has been ascribed to the very general use of potatoes; whilst in France and Russia the rareness of this disease is similarly ascribed to the almost universal consumption of thin light wines as a beverage. Rice, which has been frequently proposed as a substitute for potatoes, has, however, been proved to be utterly valueless as an antiscorbutic. Again, the evil effects of salt meat are notorious, but fresh beef alone is capable of preserving health for almost any time.

These facts are found to agree perfectly with the potash theory of scurvy. The mineral constituents of lemon-juice are found to be extremely rich in potash, containing, according to Mr. Witt, upwards of 44 per cent. of this alkali. There is an opinion that the juice of the lime (*Citrus limetta*) is stronger and more acid than lemon-juice, but in chemical constitution there is not much difference between the two. Fresh vegetables, as a rule, are rich in potash salts; potatoes, which may be placed at the head, containing no less than 51 per cent. in their ash, according to Way and Ogston, and 55 according to Griepenkerl. Grape-juice, which may be considered as the representative of the light wines so largely used in the French and Russian marine, contains in its ash from 60 to 70 per cent. of potash, while the husks of grape have an ash containing 37 per cent. Rice, however, contains only 20 per cent. in its ash.

Dr. Garrod, who has examined various kinds of food in reference to this point, gives the actual amount of potash contained in different alimentary substances. From this we learn that—

One ounce of	rice	contains	0·005	gr. of potash
,,	lemon juice	,,	0·852	,,
,,	boiled potato	,,	1·875	,,
,,	raw beef	,,	9·599	,,
,,	salt beef	,,	0·394	,,

But without assuming that the active principle of these various antiscorbutic foods is the potash which they contain, there is no doubt whatever that chemical analysis is abundantly able to show the quality of lime-juice in an accurate and rapid manner. The constituents of lime-juice are not many, the organic part contains citric acid, mucus, vegetable albumen, pectin, and sugar; whilst the inorganic constituents, consist nearly half of potash, and the rest of the ordinary ingredients of the ash of plants. It is certain that most of these have no action as far as scurvy is concerned, and a little investigation could not fail to show whether the specific consisted of the potash or some other constituent. The work of the analyst would then be to see *generally* that the article was in a state fit for food and likely to keep, and *specially* to see that the percentage of the active ingredient did not sink below a certain standard. Too much stress has been laid on the considerable time which it is supposed lime-juice would take to analyse; and Dr. Leach has stated "authoritatively that any juice may be safely pronounced good, bad, or indifferent, in *from twenty to thirty hours* after its receipt by the inspecting officer." This is far longer than would be required. When once the appliances for such analyses were in working order, we do not hesitate to say that a skilful chemist would supply all the necessary information in a couple of hours.

Assuming, as will most likely prove to be the case, that the potash salts are the specific agents against scurvy, chemical analysis is seen to be indispensable in the selection of antiscorbutics for use on board ship. It then, however, becomes a question whether the active agent could not be stored and administered with far more economy, ease, and efficacy in the form of some convenient pharmaceutical preparation (such as the *granulated effervescing citrate of potash*) than when given through the exceedingly unscientific, clumsy, and ofttimes repulsive expedient of serving out lemon-juice to the men. It might also be worth while to ascertain whether the desired end could not be secured by letting chloride of potassium partially replace chloride of sodium in the preservative processes to which the provisions are subjected.

Whether every sample of lime-juice should be separately examined before shipment, or whether Dr. Stone's suggestion be adopted of licensing a limited number of lime-juice vendors, and occasionally verifying the genuineness of their commodity by analysis, is a matter which need not at present be discussed.

LONDON WATER: PAST, PRESENT, FUTURE.

PRESENT.

We gave in our last number a summary of the labours of a scientific commission, with a double aim—1st. To show the amount of accurate and concise information attainable by these means; 2nd. To show that the same questions that were answered then have to be answered now, after an experience of fifteen years. Of nearly

46,000,000 gallons then supplied, 20,000,000 gallons were taken from the Thames, leaving 26,000,000 gallons obtained from other sources. The New River Company water was chiefly derived from springs and small streams, and from the River Lea above Ware. The East London supply was from the Lea, six miles from its mouth, two miles beyond the tidal reach of the Thames; the Kent Company, from Ravensbourne; Hampstead, from the springs and artesian wells of that district; the Lambeth Company took the water from Lambeth (the lowest point then where water was obtained from the Thames); the Chelsea Company had their works at Battersea, above Vauxhall Bridge; the West Middlesex from Barnes; the Grand Junction from Kew Bridge. The West Middlesex and Grand Junction supplies alone were above the returning tide of the river.

Since the Report, the main source of the Lambeth supply has been removed to Thames Ditton, the highest point where water is taken from the river. The supply per head was 19·4 gallons. At present the supply is much greater, being over 30 gallons per head. As regards quality also the improvement is not less marked, and that chiefly from the filtration mentioned as being so necessary if the London supplies were still to be drawn so largely from the Thames. In 1851 the average hardness of the river water from all sources was 14·4 (by Clark's test); London water from other sources 15·3°, at present the respective numbers of degrees are 13·03 and 15·7. So the Thames water has been rendered a trifle softer, and the other metropolitan water is much about the same as it was. Dr. Letheby by his analyses has shown the great improvement in the amount of solid matter per gallon, which is lessened by from two to five grains in amount. Volatile organic matter is entered at present as 1 grain per gallon, against 1½ to 3 grains in 1851, as regards the Thames. So it may be said, indeed, that an improvement in quality has been effected in these respects, especially as regards the volatile matters; but the reduction in the whole solid matter per gallon is slight when compared with the quantity still in the water. Thus a reduction of 1 to 3 grains is almost insignificant when the totals range still from 18 to 20 grains in the gallon in the waters of the various companies. Dr. Letheby remarks that the quantity of organic matter in the metropolitan water is surprisingly small; as for the quality, there is no evidence, physical or chemical, to show that this is otherwise than harmless. As far as any test can be applied, it appears chemically, according to Dr. Frankland and Dr. Letheby, who have made the most extensive researches in the matter, that the present London supply is faulty chiefly as regards the hardness of the water, and that the East London Company's water is, if anything, rather better than the average.

(To be continued.)

Fire at Dr. A. Voelcker's.—On Wednesday, the 13th inst, a destructive fire occurred on the premises of Dr. A. Voelcker, 11, Salisbury Square, Fleet Street, which greatly damaged the valuable museum and collection of minerals, manures, &c., therein contained. We are glad to hear the contents were insured.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Application of the Blowpipe to the Quantitative Determination or Assay of Certain Metals, by David Forbes, *F.R.S., &c.**

The present communication is merely to be regarded as an introduction to a more lengthened and detailed treatise on the application of the blowpipe to both qualitative and quantitative research, which it is expected will be ready for publication before the expiration of this year. It is, however, hoped that the notes here brought forward may prove of some interest and utility to those chemists who hitherto may not have paid much attention to the employment of the blowpipe in the quantitative determination of those metals to which it has been found applicable.

It will doubtless be admitted that, in this country, but very little attention has been paid to the use of the blowpipe, and more especially to its employment in assaying; and it is probable that this result is in part due to the want of any satisfactory text-book in English for the guidance of the beginner, and in part also to the idea frequently entertained that a whole lifetime is required in order to attain any proficiency in its employment. Whilst, however, it is not denied that considerable practice and devotion to the subject is requisite for the development of the full powers of this instrument, still it is believed that, after a few trials, the beginner will be so encouraged as afterwards to follow up the subject *con amore*.

These remarks are more especially addressed to the traveller, whether mineralogist, metallurgist, or miner; for certainly the use of this instrument affords him means of obtaining expeditiously, and upon the spot, results which he could not possibly acquire without recourse to a chemical laboratory, seldom under such circumstances at his command.

For this reason also the apparatus here to be described, will be such as is more exclusively adapted for travelling purposes, from being as portable and occupying as little space as possible; and it may be stated that the complete blowpipe apparatus, which has safely accompanied the author in some seventeen years of rough travels in Europe, America, &c., and has been shaken in saddle-bags over thousands of miles without injury, is contained (balance included) in a small leather case measuring only twelve inches long, six broad, and ten and a half inches in depth.

Blowpipe.—Provided the blowpipe is furnished with a chamber for the condensation and retention of the moisture expelled with the breath, it matters little what form of instrument is used. The form adopted long ago by Gahn is considered, however, as the most convenient. Fig. 1 shows an improvement made by the author upon this form.

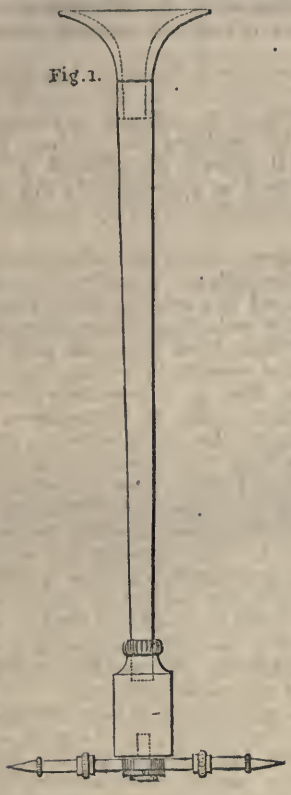
In this figure it will be seen that the arm of the jet is double, turning upon a central hollow axis, which allows the blast to be directed at will through either half of the arm, merely by rotating the arm itself half round; by having consequently the two holes with respectively a large and small orifice, a corresponding blast may be obtained at pleasure, without suspending the operation.

As a more steady and long continued blast is required in quantitative operations than could be kept up by using

* Communicated by the author.

a blowpipe provided with an ordinary mouthpiece held between the lips, without seriously distressing the muscles of the cheeks, it is quite essential that the trumpet mouthpiece, shown in Fig. 1, be adopted; for the same

Fig. 1.



reasons also the mode of holding the blowpipe represented in Fig. 2 is recommended as securing the greatest steadiness from motion, and as greatly assisting the muscles of the cheeks by the external support afforded them by the position of the thumb pressing against the trumpet mouthpiece.

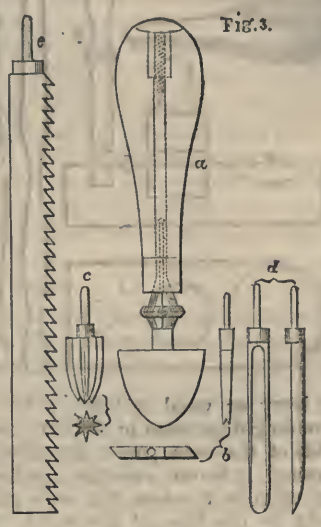
Fig. 2.

Combustible.—Olive oil, burnt in the usual Berzelius blowpipe lamp, is probably superior to any other. Gas is not to be recommended, as it is difficult to obtain a good reducing flame when using it. For cupellation and such other operations, however, which only require an oxidating flame, it is excellent.

Charcoal.—It is extremely difficult to obtain, in England, charcoal fit for blowpipe operations, without special preparation. The charcoal sold is generally of hard wood, badly burnt, full of cracks, and decrepitating upon application of heat. Good charcoal should be soft, yet compact, and without cracks, and is best made from fir or pine. Where good charcoal cannot be obtained it can be made artificially by moulding charcoal powder agglutinated by some starch paste, and, after desiccation, burning the pieces in a crucible filled with sand.

For the preparation of the charcoal used as a support for the assays, the instruments represented in Fig. 3 are required, all of which are fitted in the universal handle *a*, which is shown in this figure as holding the

Fig. 3.



largest charcoal borer, a section and plan of which are shown in *b*. This large borer is employed for forming the deep holes in the charcoal used in the blowpipe furnace, and which serve to contain the clay crucibles or capsules in which the assays are fused. The blast holes in the charcoal inside the blowpipe furnace are bored out by the gouge-shaped borer *d*, which also serves for making small holes or grooves in charcoal for general purposes. The smaller borer *c* is most useful, particularly in boring out the holes for receiving the soda paper cornets containing the assay for reduction. The sawknife *e* also fits into the same handle, and is used for trimming and sawing across the charcoal pieces, having coarse saw teeth in front, whilst the back presents a sharp knife edge. The figures are all drawn to one-half of the real size.

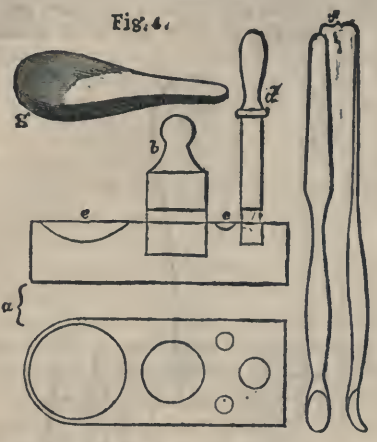
Instruments.—In the course of these notes any special apparatus required for the execution of the processes will be described, but other instruments, as forceps, lamp-trimming tongs, small hammer, agate mortar, scissors, magnifier, pliers, platinum wire, and holder, &c., are sufficiently familiar to everybody as not to require description.

Preparation of the Substance to be Examined.—In all cases the mineral substance to be assayed must be reduced to fine powder, as, if employed in grains, as is generally recommended in qualitative blowpipe examination, some loss by decrepitation is risked, and the flux employed would not act equally upon the assay.

A small diamond mortar is extremely convenient for breaking up the mineral into powder; but the steel instrument of the author, shown in Fig. 4 *a*, is recommended as combining both diamond mortar, anvil, and several other conveniences, whilst occupying the least possible space. In this figure it is seen both in section and in ground plan of its upper surface (the lower surface being merely a smooth plane for use as an anvil). At *b* will be noticed a small diamond mortar, whilst at *c* and *e* depressions of different depths and diameters are shown, which are found very useful in separating

the slag and metal beads from one another by a tap of the hammer, and for other purposes.

Fig. 4.



The small ivory or wood cylinder *d* fits so loosely in its corresponding depression in the anvil as to allow a couple of folds of the soda paper, hereafter described, to be rolled round it before insertion, and after withdrawal of the cylinder it leaves the soda paper cornet standing firmly in the hole of the anvil, which thus serves as a convenient stand for it whilst being filled with the assay.

All these figures, as well as those in Figs. 1 and 3, are correctly drawn to one half their real size.

Fig. 4 *g* represents a small scoop for mixing the assay with its flux before transferring it to its soda paper cornet, and is generally made of sheet brass or German silver; platinum is, however, preferable, as it occasionally will serve for heating a substance, and for the determination of ignition loss, or water, mercury, &c. Small scoops made of horn are made in Germany, and are, in default of platinum ones, employed when mercurial compounds are assayed.

Fig. 4 *f* is a small ivory spatula, and at the other end a spoon, and is used for mixing and weighing out. The spoon is used also as a measure for determining the quantity of flux to be added to the assay, in order to avoid the more tedious process of weighing the same.

Reagents.—The substances used in quantitative assaying are—Borax glass in two forms, as fine powder, and as small splinters of about the size of duck-shot; vitrified boracic acid in the form of powder; anhydrous pure carbonate of soda in powder (free from sulphate); monobasic phosphate of soda ($NaOPO_3$) in powder, formed by heating microcosmic salt to dryness; pure metallic arsenic in powder; arseniate of potash free from sulphate; anhydrous chloride of sodium, free from sulphate; pure graphite; pure assay lead, finely granulated; and bone ash in two states, as a moderately fine powder and as an impalpable levigated powder. In addition to these substances, the metals, iron, gold, and silver, as well as one or two compound fluxes, are required for some special operations, under which they will be treated of. As a general rule, weighing the quantity of these substances required in fluxing an assay may be avoided by knowing the amount contained in the small ivory spoon before described—for example, the spoon used by the author holds, when filled level, 6 grains of granulated lead, or 1 grain of anhydrous carbonate of soda, or 0·8 grain of pulverised borax glass, or 3·5 grains of powdered metallic arsenic, or 0·7 grain of powdered vitrified boracic acid, and so on; but naturally, as any two spoons may not be of exactly the same dimensions, each operator should find out these values for himself.

The substances should be well dried and kept in close-stoppered bottles, as it is quite impossible to obtain accurate results if reagents are used which are not anhydrous.

Soda-paper.—As it would be impossible to submit any powdered sustance to the direct action of the blowpipe flame without its suffering mechanical loss, some means must be employed for holding the particles together until they are so agglutinated by the heat that no such loss need be apprehended; this is secured by the use of the soda-paper envelope or cornet, as devised by Harkort.

For this purpose slips of thin, slightly-sized, writing paper, about one inch and a quarter long by one inch broad, are steeped in a solution of one part crystallised pure carbonate of soda (free from sulphate) in two parts of water. When dried these are used for forming small cylindrical cornets, by rolling them round the ivory cylinder Fig. 4 *d* previously described. A bottom is formed to them by folding down a portion of their length on to the end of cylinder, which is then pressed firmly into the corresponding mould in the blowpipe anvil, and which, upon the withdrawal of the cylinder, serves as a support until they are filled with the assay from the scoop, in which the assay and flux have been mixed. After pressing the assay down, the superfluous paper is cut off, leaving only sufficient, when folded down upon the contents of the cornet, to form a paper cover to the top similar to the bottom of cornet. The assay is then ready for placing in a bore in the charcoal, formed by the charcoal borer *c*, Fig. 3, and is then submitted to a reducing fusion.

Balance.—Any balance, which will weigh with accuracy to the one-thousandth part of a grain, will serve for blowpipe analysis; but as such balances are rarely met with sufficiently portable for travelling purposes, the author recommends one devised by himself in 1852 for this special purpose, and which is now constructed by Messrs. Ladd and Oertling, Moorgate Street, from whom it can be obtained. A description would, however, take up too much space in these columns.

The quantity of a mineral, to be employed in an assay, varies naturally with the character and fusibility of the substance in question, but from one to two grains will be found generally sufficient, unless the substance be extremely poor in the metal sought for, in which case it may be often advisable (as in some very poor argentiferous lead ores) to make two or more assays; and before finishing them to unite the half completed results, and then finish the assay upon the total. When great care is requisite, it is often advisable to make a rough preliminary assay, which serves as a guide in a subsequent more correct one.

The difficulty, in commercial assays, is not in getting accurate results of the assay actually operated upon, but in getting the small quantity actually employed to represent faithfully the whole bulk of the mass; in case of fused products, as regulus, speiss, &c., this difficulty is in great measure avoided.

(To be continued.)

On the Separation of Palladium and Copper, by F. Wöhler, *Professor of Chemistry in the University of Göttingen.**

I have lately discovered a new method for separating

* Communicated by the author.

palladium and copper. The mixed metals are dissolved in aqua regia, and the excess of nitric acid is driven off by heat. The liquid is then saturated with sulphurous acid gas, and a solution of sulphocyanide of potassium is added. This has no action upon the palladium, whilst it precipitates the copper in the form of a white subsulphocyanide, $Cu_2C_2NS_2$. This may easily be changed into Cu_2S or CuO, and the quantity of copper thereby ascertained.

Note on the Determination of Woody Fibre, by R. Warington, *Jun., Assistant to the Professor of Chemistry, Royal Agricultural College, Cirencester.**

In analysing a vegetable substance with a view to ascertain its worth as food, the chemist generally seeks to discover, among other things, the amount of insoluble woody fibre which it may contain; nor is this an unimportant part of his investigation, since the fibre is the most indigestible of all the food ingredients.

The general method of determining woody fibre is probably well known. The vegetable substance is first boiled in dilute sulphuric acid, which dissolves sugar, gum, starch, and the more delicate portion of the cellulose; the undissolved matter is then further boiled with a weak solution of caustic soda or potash, which removes fatty substances and albuminoids; the final residue is then, after suitable washing, &c., weighed as fibre.

A determination of woody fibre is clearly not a determination of the total cellulose present, but only of that portion of it which possesses a certain degree of insolubility; in a complete analysis both soluble and insoluble cellulose should be determined; but the latter, as most important, is that chiefly looked to in agricultural analysis, and to it the name of woody fibre is generally given.

It is much to be wished that this distinction of meaning between cellulose and woody fibre were carefully maintained in describing the composition of vegetable substances. The matter becomes exceedingly perplexing when determinations of insoluble fibre are spoken of as cellulose, and determinations of total cellulose as woody fibre. This confusion is very apparent in the tables contained in Watts' Dictionary; thus, according to one analysis there quoted, wheat bran contains 30 per cent. of cellulose, according to another only 9 per cent. Both of these figures appear as cellulose; the last is, however, without doubt, insoluble fibre. In the same way the cellulose contained in Indian corn is made to vary from 20 per cent. to 4 per cent., and the cellulose in wheat grain from 12 per cent. to 1·4 per cent. From what we know of these substances we may say with tolerable certainty, that the smaller numbers here given represent determinations of woody fibre, and not of total cellulose.

The method we have mentioned for estimating woody fibre will, of course, give various results if the acid and alkali employed are not always of the same strength. At the present time different chemists employ different strengths of acid, and though the stronger acid is generally allowed to act for a shorter period, the results of two laboratories are often in imperfect agreement. It is much to be wished that a definite strength both of acid and alkali were universally adopted.

There is, besides, a source of error I have not seen noticed, due to the presence of oily or fatty matter in the substance analysed. In seeds the oil is frequently found in intimate union with the outer membrane, which also naturally contains the chief part of the fibre. The oil thus associated with the fibre appears to protect it to some extent from the action of the acid, and thus the insoluble fibre finally weighed is really estimated too high.

In the following table the practical effect of this protective action appears; in one column is given the percentage of woody fibre, as shown by an experiment on the fresh sample; in the next column is the amount found after removing the oil by means of ether:—

	Woody Fibre before Removing Oil.	Woody Fibre after Removing Oil.
Linseed cake (1) . .	14·28	11·60
Linseed cake (2) . .	6·51	6·19
Cotton cake . . .	17·40	16·78
Wheat bran . . .	10·15	8·31
Indian corn meal . .	4·84	1·36

The error due to the presence of oil clearly varies a good deal; in the first linseed cake it is considerable, in the second practically nothing. The percentage of oil in each of these cakes was about the same, but their character, as shown by the proportion of fibre, was widely different; they represent, indeed, the maximum and minimum amount of fibre found in linseed cake. The most striking among the other examples is that of the Indian corn meal, which, after removing the oil, is seen to contain but 1·36 per cent. of fibre.

The possible source of error pointed to by these experiments is easily avoided. The oil is always separated by ether in the course of analysis, for the sake of determining its amount. The fibre can, therefore, be estimated after this operation without extra labour.

* Communicated by the author.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, January 22, 1867.

M. Henry Berthoud has sent to M. Damour for analysis a specimen of an alloy, fabricated by the ancient races of the South American inhabitants, composed of copper, silver, and gold. It is in the shape of a thin plate, and is ornamented with figures in relief done by the hammer. On slightly bending it, it breaks. The colour is of a pale red tint, like that of copper. Specific gravity 10·41 (water = 1), and fusibility about the same as that of gold. Exposed to the flame of the blowpipe, it melts on charcoal, and on cooling acquires a greyish coating. Melted with borax in a small cupel it gives a bluish-green tint to the flux, and is transformed into a red globule, which is hard enough to resist the pestle when placed in a mortar, but which is flattened out under the hammer. Melted with phosphorous salt, this alloy gives a very deep bluish-green colour to the flux, and it remains in the state of a malleable yellowish-white globule. It is easily soluble in nitric acid, even cold, leaving the gold in a spongy state, preserving the form of the specimen submitted to experiment.

Analysis gave the following results:—

Gold	0·3549
Silver	0·1194
Copper	0·5235
	0·9978

The method was as follows:—The alloy is first treated with nitric acid, leaving, as above stated, the gold in a spongy state. The silver is precipitated by a few drops of hydrochloric acid, in the form of chloride, which can be measured. A hot solution of potash precipitates

the copper is an oxide, which can be washed, dried, and weighed in its metallic state by reduction in a stream of hydrogen gas (the method of MM. Millon and Commaille). We know of no natural composition of these metals alloyed in a like proportion; gold and silver are frequently mixed together in the mineral kingdom, united together in different proportions, as is evident from numerous analyses, and especially those made by M. Boussingault; but gold ore has never been found containing more than 4 to 5 per cent. of copper. We can therefore consider it certain that the 52 per cent. of copper indicated by the analysis in the alloy above stated has been added to argentiferous gold ores by the Indian manufacturer either to give more rigidity to the metal or to increase its volume. This specimen of American archæology under notice formed part of the collection made by M. Jomard, recently purchased by M. Berthoud; it was found in the ruins in the territory of Medellin, near the Magdalen river (New Grenada); its fabrication dates from a period which it is difficult to ascertain, but it may be considered as antecedent to the conquest of America.

So wide is the field open for the different combinations of the hydrocarbons that nomenclature has become embarrassing. M. Maumené recommends a system which we place before our readers. A uniform termination for the names of these substances has for some time past been used to denote the various compounds of the hydrocarbons, *ène* in French and *en* in English. But this rule has not always been followed. Many names terminate in *yle*, and as many hydrocarbons end also in *ine* and *ol*, we have current the four terminations for substances of the same nature *en*, *yle*, *ine*, and *ol*.

It would be easy to return to the ordinary rules—that is to say, 1. To give to all the hydrocarbons names having the same termination—*en*; 2. To render them as simple as possible; 3. Not to attach the names to any theory; 4. To express as well as possible the composition of the substance.

1. Considering C_2H_2 as a molecular unity, the group or class can be represented by $C_{2n}H_{2n}$ or $(C_2H_2)_n$ in expressing the values of n by the customary words dy, tri, tetra; thus for the first group we may make use of these terms—

Monene . . .	C_2H_2
Dyene . . .	C_4H_4 or $(C_2H_2)_2$
Triene . . .	C_6H_6 or $(C_2H_2)_3$
Tetrene . . .	C_8H_8 or $(C_2H_2)_4$ &c.

2. For all the groups and classes in which the carbon dominates $C_{2n}H_{2n-x}$, the author proposes to insert between the words *mono*, *dy*, *tri*, and the termination *ene*, the letter of the alphabet corresponding by its order to the value of x—for example, to designate the hydrocarbons $C_{2n}H_{2n-6}$, he places the letter F, as being the sixth letter of the alphabet, and we have—

Monofene	=
Dyfene	=
Trifene	=
Tetrafene	$= C_8H_2$?
Pentafene	$= C_{10}H_4$
Hexafene	$= C_{12}H_6$ (benzine, benzol)
Heptafene	$= C_{14}H_8$ (toluene, toluol)

3. For the groups in which the hydrogen predominates, $C_{2n}H_{2n+x}$, the author interposes between the syllables mono, dy, &c., and the termination *en*, the word hydro, which is followed by the latter in the order of x. The result is the denoting of two groups of names very short, and, at the same time, expressive. For example, the names of the hydrocarbides, $C_{2n}H_{2n+1}$, *monohydro* ending in *ene*, and by elision—

Monhydrene	C_2H_3 (methyl)
Dihydrene	C_4H_5 (ethyl)
Trihydrene	C_6H_7 (propyl)
Tetrhydrene	C_8H_9 (butyl)

This nomenclature, so simple, is accompanied by a slight inconvenience that can be easily got rid of.

1. The names of the 8th group $C_{2n}H_{2n-7}$ in pronunciation is confounded with that of the 10th, $C_{2n}H_{2n-10}$, or

Pentagine $C_{10}H_3$, Pentagene $C_{10}H_2$.
Hexagine $C_{12}H_5$, Hexagene $C_{12}H_2$.

To remedy this, M. Maumené puts an *i*, thus—

Pentageine,
Hexageine,
Heptageine, &c.,

and thus saves the trouble of a mistaken pronunciation.

2. The names of the 3rd group $C_{2n}H_{2n}$, and those of the 9th $C_{2n}H_{2n-8}$ present a similar difficulty—

Hexene, Hexhene,
Heptene, Hepthene,

or by elision—

Hexahene,
Heptahene,
Octahene.

There is no other difficulty.

On the report of the Surgical Commission of Inquiry, and the awarding of prizes for meritorious labours, the French Photographic Society has presented a medal to MM. Jessie de Mothay et Maréchal for their process of the production of vitrified photographic images on glass, crystal, porcelain, and lava. Their processes, says the report, open a new field to photography by reproducing faithfully the very sketch of the artist. The successive employment of the iodo-cyanide and cyanide baths, which allow of a thick coating of metal to be used, which it is necessary to deposit on objects of this nature, is in itself an improvement of considerable interest. F. Moigno.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, January 17.

Professor W. A. Miller, *M.D., V.P.R.S., President, in the Chair.*

Mr. Edward J. Sparks was formally admitted a Fellow of the Society. The names of the following candidates were read for the second time, viz.:—James William Hudson, Ph.D., Principal of Trafford College, Manchester; Mr. Joseph Ince, Associate of King's College, London, 26, St. George's Place, Hyde Park Corner; and Mr. George Otley, 196, Walworth Road. For the first time were read the names of Mr. Jonathan Hearder, Plymouth; Mr. R. R. H. Davey, of the War Office; Mr. Frederick George, Cheltenham; Mr. Martin Henry Payne, 47, Mortimer Street, Cavendish Square; Mr. William Thurston Waite, 37, Jewry Street; and Mr. Henry Weston Eve, M.A., Wellington College, Wokingham.

The Secretary read a paper by Mr. T. E. Thorpe, Dalton Scholar, Manchester, "*On the Amount of Carbonic Acid contained in Sea Air.*" The author traced the history of previous researches, and referred particularly to the experiments of Lewy, who, in 1848, determined the amounts of carbonic acid and of the principal gaseous constituents in air collected over the middle of the Atlantic Ocean at different periods of the day and night. These analyses had been conducted in the eudiometric apparatus of Regnault and Reiset, which subsequent experience has shown to give fallacious results. Lewy indicated a considerable increase of carbonic acid during the daytime; in fact, the amount of this constituent was said to vary between 3·346 parts at 3 a.m., and 5·42 parts at 3 p.m., in ten thousand volumes of air under similar meteorological conditions, whilst the oxygen suffered a corresponding change from 2096 to 2106 volumes. The quantitative estimations described by Mr. Thorpe were made according to Pettenkofer's method, an aqueous solution of baryta being employed to absorb the carbonic acid from a known volume of air, the excess of baryta being ascertained by the use of a standard solution of oxalic acid. The author's

first experiments were made in the Irish Sea in August, 1865, on board the "Bahama Bank" light ship, which is situate seven miles from Douglas, Isle of Man, and consequently about equidistant from the shores of England, Scotland, and Ireland. The results and meteorological conditions are given in the form of a table, wherein it is seen that there is no perceptible variation in the amount of carbonic acid during the day and night, the hours of 4 a.m. and 4 p.m. having been selected for the observations, these times coinciding with the maximum and minimum temperatures. Similar experiments were made last year in many latitudes of the Atlantic Ocean during voyages to and from the Brazils. The results are nearly identical with the former, and the amount of carbonic acid is said to be 3·00 parts in 10,000 of air, as the general average of the whole series of seventy-seven observations.

A second part of the author's paper describes "*The Amount of Carbonic Acid contained in the Atmosphere of Tropical Brazil during the Rainy Season.*" Para was the station selected for experiment; its position on the Amazon is eighty miles from the sea. In April and May last the proportion of carbonic acid was found to be no more than 3·28 parts, whilst 4 may be quoted as the mean result for the atmosphere of Europe. The latter figure is, however, known to be often exceeded in localities not far removed from the contaminating influences of manufacturing operations and other causes.

The President proposed a vote of thanks to the author for his interesting communication.

Dr. Frankland was then invited to read a paper entitled "*Synthetical Researches on Ethers.—Part II. Action of Sodium and Isopropylic Iodide upon Ethylic Acetate,*" being a continuation of a memoir presented by himself and Mr. B. F. Duppa on a previous occasion to the Society.* The lecturer stated that two distinct classes of bodies resulted from the reactions already described—viz., 1st. Products derived from the duplication of the molecule of ethylic acetate; and 2nd. Bodies resulting from the substitution of one or more atoms of hydrogen in the methyl of acetic acid. Examples of the two classes were thus written,—

Type of Carboketonic Ethers.	Ethylic Disodacetate.
$\left\{\begin{matrix}COMe\\CR_2\\COEto\end{matrix}\right.$	CNa_2H $COEto$

Dr. Frankland then showed the mode of formation of the last-named body, and the nature of the ethylic salt resulting from the action of the iodide of an organic radical. Previous experiments had determined the results in the cases of the employment of the ethylic, methylic, and amylic iodides; the authors proceeded now to extend their investigations to the products obtained by the action of the isopropylic iodide. By the operation of sodium upon ethylic acetate, a carboketonic ether was formed, which was then digested with the isopropylic iodide employed in excess. At the end of four hours the more volatile products were distilled off by the heat of a water bath, the residual portion was acidified with dilute sulphuric acid, and again submitted to distillation. An oily liquid of agreeable odour passed over, which was a mixture of ethylic acetate, alcohol, isopropylic iodide, and two new bodies, one boiling at about 135° C., and the other when purified at 201° C. This last named substance proved on analysis to be a true carboketonic ether, to which the name *ethylic isopropacetone carbonate* is applicable. Its formation was thus accounted for,—

$$\left\{\begin{matrix}COMe\\CNaH\\COEto\end{matrix}\right. + \beta PrI = \left\{\begin{matrix}COMe\\C\beta PrH\\COEto\end{matrix}\right. + NaI.$$

Ethylic Sodacetone Carbonate. — Ethylic Isopropacetone Carbonate.

When pure, its odour might be compared with that of "damp straw in a state of incipient fermentation." It is not soluble in water, but easily miscible with ether and alcohol. Boiled with baryta this substance furnishes isopropacetone, a mobile liquid possessing a powerful camphoric odour and a burning taste. An analysis of this substance led to the formula $C_6H_{12}O$. Boiling point 114° C. It does not reduce a boiling solution of argentic nitrate, but gives the usual white crystalline body when mixed with an alkaline sulphite. Isopropacetone is considered by the authors to be isomeric with Dr. Williamson's ketone, boiling at 120° C., and also with ethyl butyral, which boils at 128° C. There were indications of the existence of a second body containing two atoms of isopropyl, but the ethylic di-isopropacetone carbonate has not yet been isolated. The other new substance, to which reference has already been made, boiled constantly at 134—135° C., and proved to be *Isopropacetic Ether*. Analysis led to the formula $C_7H_{14}O_2$, and it is consequently isomeric with ethylic valerate. From this compound the *Isopropacetic Acid* was prepared, which boiled at 175° C., and had an odour similar to that of the normal valeric acid made from amylic alcohol. It is an oily liquid, soluble to a slight extent in water, and exhibiting acid properties. The silver-salt was prepared and analysed. Its formula is—

$$C_5H_9AgO_2 = \left\{\begin{matrix}C\beta PrH_2\\COAgO.\end{matrix}\right.$$

The constitution of the new bodies is shown in the author's paper by the aid of graphic formulæ, and the existence of a third member of this group of isomeric acids is already ascertained, and will form the subject of a separate communication to the Society. It is the *Trimethacetic Acid*, having the formula—

$$\begin{matrix}CMe_3\\COHo.\end{matrix}$$

Dr. Frankland proceeded, finally, to institute a comparison between the properties of isopropacetic and valeric acids, which are identical in all respects save one—viz., the power which the latter possesses in common with its ether of rotating a beam of circularly polarised light—a physical difference which fully bears out the authors' theoretical assumptions based upon their different synthesis.

A few remarks by Drs. Debus and Odling followed the reading of the paper, and the President proposed a vote of thanks to Professor Frankland and Mr. Duppa for their interesting communication.

Professor J. A. Wanklyn then gave an account of a new mode of analysis in a paper entitled "*Titration of the Compound Ethers.*" After referring to the unsatisfactory nature of the indications afforded by the combustion of the compound ethers as a guarantee of purity, Professor Wanklyn described a very expeditious and accurate mode of titrating them. Known quantities of the ether and of alcoholic potash were heated in a sealed tube, and the excess of alkali remaining was afterwards determined by a standard solution of sulphuric acid, the last stage of visible blue tint in the litmus serving as the point of saturation. A number of examples were given in illustration of the accuracy of the method. Thus, 100 parts of benzoate of ethyl, when saponified, should yield theoretically benzoic acid capable of saturating 26·06 parts of potassium. The numbers found by experiment were 25·77 and 25·78.

The President having elicited some further particulars indicative of the rapidity with which these experiments could be conducted,

Dr. Williamson said he considered the method now proposed by Professor Wanklyn would be likely to prove of great value, since the results of the ultimate analysis of these ethers were altogether unsatisfactory, and he thought it desirable to endeavour to extend the principle to the examination of other classes of bodies.

A paper on "*Quantitative Analysis by Limited Oxida-*

* *Jour. Chem. Soc.*, vol. xix., p. 395.

tion. Examples: Lactic and Diethoxalic Acids," by Messrs. Ernest T. Chapman and Miles H. Smith, was read by the first-named gentleman. The authors referred to a previous paper (Chapman and Thorp, *Journal Chem. Soc.*, December, 1866), in which it was distinctly proved that the normal acids of acetic series are not attacked by dilute chromic acid. It was also shown that these acids resist attack, even in the nascent state. From this observation it follows that all the carbon of alcohol, for instance, may be obtained in the form of acetic acid. The authors have oxidised the lactic and diethoxalic acids with a ten per cent. solution of bi-chromate of potash, containing just enough sulphuric acid to produce chrome alum if all the chromic acid were reduced. Lactic acid, as is well known, yields, when oxidised with binoxide of manganese and sulphuric acid, aldehyde and carbonic acid. With the bichromate solution the same results are obtained. The authors, having carefully determined the amount of carbonic acid liberated, find that almost exactly one-third of the carbon passes off in this form, thus proving the equation:—

$$\left.\begin{matrix}\mathrm{CMeHHIo}\\ \mathrm{COIo}\end{matrix}\right\} + \mathrm{O} = \mathrm{CMeHo} + \mathrm{H_2O} + \mathrm{CO_2}.$$

Lactic acid. Aldehyde.

They also determined the amount of acetic acid formed from a known weight of lactic acid, which, converted into barium salt, proved to be within one or two-tenths per cent. of the quantity required on the assumption that one equivalent of lactic acid yields one equivalent of acetic acid. The authors find that diethoxalic acid (the acid obtained by Frankland and Duppa by the action of zinc-ethyl on oxalic ether) when treated with the above oxidising mixture splits up with the greatest ease into carbonic acid and propione. The former was accurately determined, and found to correspond to one-sixth of the total amount of carbon in the compound. The propione also was determined. This was effected by operating in an atmosphere of carbonic acid, and subsequently absorbing this gas by potash, by which device all loss from effusion is avoided. The result of this operation was that the amount of propione obtained was within 0·6 per cent. of that demanded by theory. This was said to be the only instance on record of a volatile liquid having been determined with quantitative accuracy. These facts prove the following equation:—

$$\left.\begin{matrix}\mathrm{CEt_2HIo}\\ \mathrm{COIIo}\end{matrix}\right\} + \mathrm{O} = \mathrm{CEt_2O} + \mathrm{H_2O} + \mathrm{CO_2}$$

Diethoxalic acid. Propione.

The propione was in its turn oxidised and made to yield acetic and propionic acids, which together amounted to 99·3 per cent. of the theoretical quantity.

The proportion of oxygen required to convert the propione into these acids was then determined, and found to correspond to three equivalents. This result was arrived at by precipitating the sesqui-oxide of chromium reduced by a given weight of propione. From the foregoing statement it appears that the following equation is true:—

$$\mathrm{CEt_2O} + \mathrm{O_3} = \mathrm{C_2H_4O_2} + \mathrm{C_3H_6O_2}.$$

Propione. Acetic acid. Propionic acid.

Finally, the authors state that quantitative analysis of many, perhaps most organic compounds can be effected by limited oxidation, and not only should we then learn the total amount of carbon, but also the form in which it exists in the compound under examination. The results obtained in the analysis of diethoxalic acid come out as sharply as in the best combustions.

Mr. Chapman exhibited the apparatus made use of in these experiments, and showed a sealed tube containing equal weights of glacial acetic acid and crystallised chromic acid, which had been heated for a period of four hours in a water bath, without perceptible change or alteration of colour.

The Secretary read a paper "*On the Preparation of Berberine from Coscinium fenestratum,*" by John Stenhouse, LL.D., F.R.S. The plant in question is a large rope vine growing in the forests of Ceylon and other parts of India. It is met with in commerce under the name of "Colombo wood," and berberine has already been extracted from it by Mr. J. D. Perrins. The author obtains a larger yield of pure berberine, from 2 to 3½ per cent., by exhausting the groundwood with subacetate of lead solution instead of plain water. Part of the alkaloid separates out on cooling; but a further quantity is obtained on adding an excess of nitric acid to the supernatant liquid. Lime or ammonia may then be used to decompose the nitrate, and the impure berberine resulting may be further treated, as described in the author's paper, for the purpose of effecting its complete purification. Dr. Stenhouse recommends the adoption of the same process for the extraction of theine from tea.

Another paper by Dr. Stenhouse stands over to be read at the next meeting; it is entitled "*Note of some Varieties of Orchella Weed, and Products obtained from them.*" Also a paper by Dr. T. L. Phipson, "*On the Eggs of Corixa mercenaria.*" At a late hour the meeting was adjourned until February 7.

ROYAL INSTITUTION OF GREAT BRITAIN.

On Friday evening, Dr. Tyndall delivered a lecture at the Royal Institution, "*On Sounding and Sensitive Flames.*" Commencing with the history of the subject, the lecturer stated he believed Dr. Higgins first noticed the sounding of a hydrogen flame when enclosed in a glass tube; and with regard to the second part of the subject—sensitive flames—that the jumping of a naked fish-tail flame in response to musical sounds was first noticed by Professor Lecomte. He made the important discovery that the flame did not jump until near flaring.

In the first experiment, in which a candle was moved rapidly through the air, a fluttering noise was produced, and a continuous band of light, slightly indented, or raised a little at the extremities, was visible. Blowing against a candle caused a similar fluttering sound, indicative, as in the preceding case, of a rythmic action. When a fluttering of the air is caused at the embouchure of an organ-pipe, the resonance of the pipe reinforces that particular pulse of the flutter whose period of vibration coincides with its own and raises it to a musical sound. Dr. Tyndall blew into the embouchure, and obtained a musical note from an organ-pipe in this way. When a gas-flame is introduced into an open glass tube, the sound is produced in the same manner. The pitch was shown to be dependent upon the length of the tube, by using tubes of various lengths.

The fact that the vibrations of the flame consisted of partial extinctions and revivals was beautifully illustrated by throwing an image of the flame on to a screen by means of a concave mirror; when the current of air which produced the fluttering was stopped, a continuous band of light was produced by moving the mirror; when the flame was vibrating the image projected consisted of a chain of luminous spots. The possibility of making the vibrations of a singing flame start a silent flame was shown thus:—Two flames were enclosed in glass tubes which had cardboard sliding tubes, by which the length of the tube could be altered; one flame was made to sound by adjusting the length of the tube, and the vibration of this speedily caused the other to sound, which up to that time had been silent. Both flames must be so nearly in unison as to produce distinct beats. The sound of a flame in a glass tube was changed markedly by a membrane cover being placed upon the tube. Afterwards a fishtail burner was brought over the same tube, the broad side of the flame being at right angles to the axis of the tube; it immediately emitted a note of the same pitch as that of the sounding flame in the tube, but of peculiar tone—in fact, the same as that produced by the membrane in the previous experiment. Blows upon

the anvil, whistling, and other methods of causing vibrations to be communicated to the air, were shown to have no effect upon an ordinary candle-flame, but upon distorting it by means of a blowpipe, it jumped upon blowing a whistle. By the position in which the blowpipe was placed with regard to a fishtail flame, the latter was cut in two; when in this condition it became altered in shape by the sound of the whistle.

In the next experiment a bat's-wing flame was used, which was not at all affected at first, but by increasing the pressure of gas it became very sensitive, and shot up a number of forks each time the whistle was sounded; it was similarly affected by a blow upon the anvil from a hammer. Two flames, the one short and forked, the other long and straight, exactly interchanged their character upon a whistle being blown. Dr. Tyndall explained that the apathy or sensitiveness of these flames depended upon the pressure of gas; and to have the pressure at his command the gas was supplied from a small gas-holder in the lecture theatre. The flames were clearly shown to be scarcely affected by low tones; one flame of nearly 20 inches long was of marvellous sensibility, a tap on a distant anvil knocking it down to 8 inches. Tuning forks of low pitch had no effect whatever upon it, but it immediately responded to the overnotes of the forks. Similarly the blow of a hammer upon the table had no effect upon a flame, while a blow upon the anvil immediately affected it. Illustrative of the same fact, an inverted bell was made to vibrate, and produced a loud deep tone. No effect was produced upon the flame, but a coin brought in contact with the vibrating metal raised the pitch, and the flame, previously twenty inches long, fell, and re-ascended immediately. The human voice evidently affected it, some sounds more particularly. The sound of the vowel U had no effect upon the flame; O scarcely any, while E affected it strongly; the sound "Ah!" was immediately responded to by the flame. Dr. Tyndall recited a few lines from Spenser, in which particular words attacked the flame markedly. The winding up of clockwork, little jets of compressed air issuing from a small orifice, and a "hiss," all affected the flame so rapidly that we could not detect the interval of time between the sound and its effect. These last sounds were made in the gallery by Dr. Tyndall's assistant. The lecturer stated that the rustling of a lady's dress drove the flame frantic; and it was very evident during the lecture that the occasional whispering of the audience affected it powerfully.

ACADEMY OF SCIENCES.

January 21, 1867.

(From our own Correspondent.)

M. Le Verrier requested the insertion in the *Transactions* of the Academy of some notes relative to examinations of the eruptions of Vesuvius, and the newly sprung-up isles of Santorin, made by M. Fouqué, well known by his observations and studies thereon; also his experimental researches on the indices of refraction of saline solutions. His aim was to ascertain whether the law as laid down by Biot and Arago relative to gaseous mixtures was equally true for liquids. Having made experiments upon 153 solutions, he came to the following conclusions, giving, at different temperatures for each body, its chemical composition, specific gravity, and index of refraction:—

The number representing the index of refraction varies according to the temperature. From 50° F. to 203° F., this variation often attains the hundredth part, and is greater in proportion as the liquor is the more concentrated. Its refringent power diminishes when the temperature is increased, and this diminution from 50° F. to 203° F. is about the thousandth part of the original size. The dispersion diminishes also with the temperature. In the same interval the distance between the two lines A and B of the spectrum can present a difference of a thousandth part. The law of Biot and Arago, that the index of a mixture of two gases is the mean between that of the two elements which constitute it, is not strictly true in the case of its application to liquid mixtures; yet, however, it may be regarded as a very close approximation, differing little from the truth, for a great number of saline solutions.

"The Academy is already aware," said M. Coste, in a communication made on the 21st, "by communications made by several naturalists, that I have organised at Concarneau, with the co-operation of Mr. Gerbe, and the master pilot Guillon, an observatory of the inhabitants of the ocean, which is one of the most interesting innovations of modern times. There, in a reservoir 1794 square yards in extent, and 10 feet deep, divided into six compartments, hollowed out of solid granite, and defended by thick walls against the violence of the waves, we have succeeded, by means of sluice gratings that can be opened and shut at will, in imitating so well the flux and reflux of the tide that the most concealed organic phenomena of the deep are accomplished under the eyes of the observer. Not only do the greater portion of the species live there in a state of complete domestication, exhibiting their habits of life, but they carry on their reproduction, and offer a new field of inquiry to the embryogenist. We cite a few examples." The master pilot, Guillon, wrote to M. Coste that at the beginning of April, 1866, he had placed a couple of the small species of *Squalus Catulus* (Linn.) in one of the compartments of the aquarium. The female laid eight eggs during the month. These were hatched in the commencement of December. The incubation therefore lasted about nine months. The young animals are thriving. Thus, a phenomenon of the most delicate organisation was accomplished artificially with as much regularity as if it had taken place in the great deep. This is, in the opinion of M. Coste, one of the great decisive proofs of the perfection of the vast hydraulic apparatus in which he makes his experiments; thanks to this perfection, the reproductive process can be watched from day to day, from hour to hour, as well as that of a fowl from the very egg. There is also an aquarium in an adjoining building, furnished also with all appliances for closer examination, dissections, lecture-rooms, &c. In this laboratory, M. Coste offers a generous hospitality to all friends of science, and in it are drawn up all the regulations relative to the fishing laws.

M. Leverrier took up the discussion, raised by him on the 17th inst., at the monthly meetings of the Scientific Association of France, relative to the shower of falling stars during the month of November. His theory, or rather, properly so to speak, his hypothesis, is in strict analogy with that of Sr. Sciaparelli. At an early date, that is to say before the year 126 of the Christian era, these nebulous masses were of a spherical, or some other shape. At that period Uranus caused them to go out of their path, partly or wholly, and describe an elongated orbit, which brings them within reach of the attraction of the earth. The major axis of this ellipse is equal to about 70 diameters of the earth. In $33\frac{1}{4}$ years the cluster performs the revolution of its orbit, and its length is such that it occupies such a space that the duration of its perihelion passage is more than a year. M. Leverrier does not affirm the creation of the falling star clusters of November, but he demonstrates the possibility by comparing the principal positions and elements of the orbits of the nebulous masses, and of Uranus at the period of the year 126·212 of our era.

Gold Amalgam.—Three pounds of amalgam, from which the liquid metal has been carefully pressed out, will yield one pound of gold. The gold remaining after the quicksilver has been driven off by the heat from the amalgam is a porous mass, somewhat resembling sponge cake in appearance.—*Hittel's Resources of California.*

NOTICES OF BOOKS.

Intensity Coils; How Made and How Used. By "Dyer." London: Suter, Alexander, and Co.

The induction coil has now come into such general favour and is used for such varied purposes, as a medical instrument, a means of scientific research, and an amusing toy for winter's evenings, that several treatises have lately appeared, describing the best methods for its manufacture and management. The object of the little work before us is explained in the following manner in the preface:—

"What is an intensity coil? How does it differ from other coils? How is it made? What will it do? These and similar questions are being continually asked, and to furnish intelligible replies to them the following pages have been written.

"It is not a scientific treatise that is here offered to the public, but simply the necessary instructions that those who want to make or use intensity coils desire to obtain."

For these purposes the writer gives a short abstract of all the important electrical laws that are connected with his subject, and the general characteristics of dynamic and current electricity; having done which he proceeds to state the best manner of forming a tolerably powerful coil, concluding with a list of the experiments that may be performed with it when made. The following notes on the manufacture of the coil show some of the principal precautions necessary to be taken to insure perfect insulation:—

"The primary wire consists of copper wire covered with cotton or silk, and of a size known as No. 15 or No. 16, averaging about 18 to 20 yards to the pound. One end of the wire is to be passed from the inside through one of the holes in the reel end, and then carefully wound over the cylinder up to the other end, and then back again, so as to form two layers of wire one over the other.

"When the primary wire is laid on, it should be varnished with two or three successive coats of varnish composed of shellac dissolved in spirits of wine. Care should be taken that one coat be thoroughly dry before a second is put on. The varnish should be thin, so that it may be readily absorbed by the covering of the wire and conveyed to the underneath layer."

The secondary wire "is also formed of copper wire, but it must be covered with silk, and of a size known as No. 39, averaging about 100 yards to the ounce; the quantity required will be about 800 yards. In winding this wire on the reel the most scrupulous care is needed, not only to avoid any break in the wire, but also any kink or bend in it. One layer of wire is to be laid on at one time, and then most carefully varnished with shellac varnish, and when dry covered with four or five layers of gutta-percha tissue."

Any one possessed of a slight amount of mechanical skill would find no difficulty in the construction of a coil with the assistance of the directions given in this work. The many, therefore, who would prefer to construct their own instruments rather than purchase them will welcome this book as a valuable auxiliary, and will suffice to insure its success.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften (Mathematical and Natural History Section).

July, 1866.—Ad. Weiss: "*Researches on the History of the Development of Colouring Matter in the Vegetable Cells.*"—Unger: "*Short Notice on the Fossil Wood from Abyssinia.*"—Ischermak "*On Sulphide of Silver* (Silberkies)."

Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt.

No. 3, 1866, July, to and inclusive September.—"*The South-West End of the Trachytic Formation of the Region of Schemnitz-Kremnitz,*" by von Adrian, with numerous and valuable Mineralogical Analyses, by von Sommaruga and others.—"*Scientific Researches in the Laboratory:* (a) *Four Analyses of Divers Varieties of Basalt,*" by von Sommaruga; (b) "*Analysis of Melaphyr,*" by the Same; (c) "*Analysis of Badeschlamm*—i.e., *Mud Deposited from a Natural Spring;*" (d) "*Analysis of Braunkohle occurring in Carynthia;*" (e) "*Hydraulic Lime from Nadworna;*" (f) "*Analysis of English and Bilin Emery;*" (g) "*Analysis of Braunkohle from Ghymes, Hungary.*"

Monatsbericht der königlich-Preussischen Akademie der Wissenschaften zu Berlin.

August, 1866.—Dr. Rammelsberg "*On Phosphorous Acid.*"—Drs. Kummer and A. W. F. Hofmann "*On the Action of Oxalic Acid upon Aniline.*"—Sell and Liebmann "*On the Action of Mercuride of Æthyl on Monobromacetic-Æthyl.*"—Dr. Rud. Weber "*On the Formation of Protoxide of Nitrogen during the Action of Sulphurous Acid upon Nitrous and Nitric Acid.*"

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3171. J. T. A. Mallet, Boulevart St. Martin, Paris, "A process and apparatus for producing jointly or separately oxygen and chlorine from the same chemical substance and in the same apparatus."—Petition recorded December 3, 1866.

3195. C. E. Brooman, Fleet-street, "Improvements in the manufacture of colouring matters." A communication from C. Lauth, Paris.—December 5, 1866.

3269. J. Baggs, High Holborn, Middlesex, "Improvements in the manufacture and treatment of hydrochloric and nitric acids."

3273. C. E. Brooman, Fleet-street, "Improvements in the treatment of lead and argentiferous litharge." A communication from F. Cordurié, Toulouse, France.—December 13, 1866.

3293. F. W. Reeves, Cambridge Terrace, Notting Hill, and J. B. Muschamp, Pembroke Road, Middlesex, "An improved explosive substance."

3303. J. W. Swan, Gateshead, Durham, "Improvements in the treatment of gelatinous tissues, of gelatine and gum, and of compounds containing such substances."

3310. G. A. Neumeyer, Döblitz, Prussia, "Improvements in gunpowder for mining purposes."

Notices to Proceed.

2218. R. Irvine, Magdalen Bridge, near Musselborough, Midlothian, "Improvements in treating and purifying water."—Petition recorded August 28, 1866.

2470. G. E. Van Derburgh, New York, U.S.A., "Improvements in the composition and production of artificial stone, cements, and other compositions."—September 25, 1866.

3047. C. E. Brooman, Fleet Street, "A new or improved process or method of coating or covering iron and steel with copper or copper alloys." A communication from M. Bernabé, Paris.—November 20, 1866.

CORRESPONDENCE.

Commercial Analyses.

To the Editor of the Chemical News.

Sir,—I did not know that analysts were classified as "high" or "low" till I read your correspondent's letter in No. 370; but the following analysis was evidently made by a member of the latter division. Certainly either the fee or the work is too low; yet he has written a book and has initials to his name. Let us hope he is the only "low" person known at Burlington House.

I am, &c. N. D.

Analysis of a Sample of Superphosphate.

Moisture	12·42
Water of combination, with a little organic matter (containing nitrogen ·25; equal to ammonia ·30)	12·05
Biphosphate of lime (equal to bone-earth made soluble 13·03)	8·35
Insoluble phosphates	16·64
Sulphate of lime	34·52
Alkaline salts	10·82
Insoluble earthy matters	5·20
	100·00

Fee, 1*l.* 1s.

The Use of Gun Cotton in Blasting.

To the Editor of the Chemical News.

Sir,—A letter appeared in your impression of January 4, in which our name was coupled with the manufacture of gun cotton, and as the remarks there made are somewhat calculated to injure us, we trust you will allow us a short space for an explanation.

The description given by your correspondent as to the best mode of using this material is correct so far as it describes the ordinary operations of the miner when blasting with powder, the conditions under which this well-known compound can be used being identical with those required for gun cotton, our object having been so to arrange our manufacture that the employment of the two materials should assimilate as much as possible; but here the correctness of the description ends. Gun cotton is in every respect as safe, many report it safer than powder; one great danger of the latter, viz., its liability to leave grains adhering to the sides of the hole upon which friction from the tamping rod is constantly taking place, is altogether removed, the cotton goes in a mass to the bottom of the hole, and no residue forming a train by which the entire charge is exploded ever remains.

The experience of your correspondent as to results is so opposed to our own and to that of a large number of consumers, as notified to us by their letters, that we have no hesitation in saying the trials have not been properly made. In using more than one length of cotton the fuse should not be carried through the whole of the charges, such an arrangement being likely to prevent the simultaneous ignition of the pieces, thus retarding the combustion and diminishing the effect; and this was undoubtedly the cause of the poor result obtained by your correspondent. Properly applied, the cost of gun cotton (tested by the work done) is less than that of powder.

We have lately prepared a very condensed charge, one inch of which will be found equal to six inches of powder. Of our $1\frac{1}{4}$-inch diameter, five inches in length are equivalent to one pound of powder, and can be supplied for $4\frac{1}{2}$d. By the use of this in hard granite rock, a large saving in boring is effected; the charges slip readily into the hole, leave no residue on the side, and only require to have the fuse connected with the uppermost piece; the total absence of smoke, comparative freedom from danger, portability and convenience of form, combined with the saving in labour and material, are advantages which are bringing gun cotton largely into use, and are thoroughly appreciated by those workmen who, by a proper and judicious application, have reaped the full benefit to be derived from it. Thomas Prentice & Co.

173, Fenchurch Street, London, E.C.

Organic Matter in Water.

To the Editor of the Chemical News.

Sir,—Having observed no reply to your correspondent "B. J. G.," in your impression for Dec. 28, 1866, I would suggest to him the following method of determining the character and origin of the organic matter in waters. If not theoretically perfect, it possesses a practical value, and is no doubt substantially identical with that in use by Dr. Letheby. It depends upon the fact that animal matters of the kind which find their way to the sources of drinking water may be regarded as invariably containing nitrogen, and as yielding by their decomposition one of the two nitrogenised bodies, ammonia and nitric acid, which are sufficiently easy of detection. Hence, if a water be found to exercise a palpable deoxidising action upon permanganate of potash solution, which cannot be explained by the presence of any inorganic constituent (such as the protosalts of iron, &c.), and at the same time is free from both the above-mentioned bodies, the inference is inevitable that organic matter—not of animal, and therefore of vegetable origin—exists in the water. As regards the formation of these two compounds in waters subject to animal pollution, it appears highly probable that the action is successive, an early result of the breaking up of the chemically complex animal substance with simpler forms being ammonia, while nitric acid is produced by the gradual oxidation of the latter; a reaction analogous to that exhibited in the common lecture experiment, where a spiral of platinum wire is retained in a state of ignition by the heat resulting from the oxidation of gaseous ammonia, orange fumes of pernitric oxide appearing in the vicinity of the wire. Such, indeed, is most probably the history of the nitre obtained from the nitre beds, and hence of nearly all the nitric acid of commerce. If the theories above stated be well founded, it is evident that highly important conclusions may be drawn from the presence of ammonia and nitric acid in waters. Thus, if we find ammonia alone, we may infer that the animal contamination is of recent standing; while the detection of nitric acid also would imply that sufficient time had elapsed since the first infiltration of foul matters for the oxidation of the ammonia. Again, if nitric acid, and no ammonia be found, we may assume that the impurity of the water is of a temporary or intermittent character, and that its pollution had ceased some little time before the specimen examined was drawn. Each of these cases has been met with in practice by the writer. With respect to the estimations of organic matter by permanganate of potash given by Dr. Letheby in his accounts of the metropolitan waters, he seems to make use of the beautiful system lately brought before the Chemical Society by Dr. W. A. Miller, the organic matter being apparently expressed in terms of crystallised oxalic acid, the substance used by that chemist for the titration of the permanganate solution.

I am, &c.

Thos. P. Blunt, B.A., F.C.S.

Shrewsbury.

MISCELLANEOUS.

Graphitic Boron.—Professor Wöhler informs us that the February number of the *Annalen* will contain a notice of a further examination which he has made upon the copper-coloured, tabular, hexagonal crystals discovered by M. Deville and himself, and supposed to be graphitic boron. This is now proved to be a combination of boron and aluminium, AlB_2.

New Filtering Apparatus.—An economic filter and percolator has been devised by Mr. F. W. Hart. By an ingenious combination of syphon-tube and filtering medium, any test liquid may be drawn from a bottle in a state of limpidity, and, if necessary, returned again turbid to the stock for refiltration. By slight modifications the apparatus is used for filtering alcoholic ethereal or caustic alkaline solutions out of contact with the air, and it can be adapted to a water bath so as to admit of the filtration of gelatinous liquids. The apparatus is specially contrived for use amongst photographers, but it is evident that there are many uses in chemical, pharmaceutical, and manufacturing laboratories to which this apparatus can be economically applied.

Conduction of Sound by Hydrogen and Air.—Professor Tyndall, in his first lecture on "Vibratory Motion," delivered at the Royal Institution on Tuesday last, showed a novel experiment, illustrating the very low conductivity which hydrogen possesses for sonorous vibrations. A bell, struck by clockwork, was placed under the receiver of an air pump, and the air exhausted as perfectly as possible. It was stated that by applying the ear close to the glass a faint sound could still be heard. The exhausted receiver was then filled with hydrogen, when the bell was again heard to sound, although faintly. On pumping out the hydrogen all trace of sound entirely disappeared, even though the ear were placed close to the receiver. Hydrogen being about fifteen times lighter than air, it might be considered that sound would travel in an atmosphere of hydrogen as readily as it would in air exhausted to two inches barometric pressure. But on trying the experiment it was found that when two inches of air were passed into the receiver, it allowed far more sound of the bell to pass through it than did the full atmosphere of hydrogen, showing that conductivity for sound depended upon something more than mere density. It was then shown that sound travelled with almost the same ease through air exhausted to half its normal density that it did at the ordinary pressure.

The Chemists' Ball.—A ball will be held at Willis's Rooms, King Street, St. James's, on Wednesday next, January 30, under the patronage and support of the leading members of the trade, the surplus of which will be given to the Benevolent Fund of the Pharmaceutical Society. The following gentlemen have already consented to become stewards:—W. R. Barker, Esq., James Bass, Esq., W. H. Bell, Esq., Robt. Bentley, F.L.S., J. Bourdas, Esq., Elias Bremridge, Esq., Chas. Croydon, Esq., Robt. Curtis, Esq., Edward Harvey, Esq., A. Hinton, Esq., Theophilus Redwood, Ph.D., C. H. Savory, Esq., W. A. Tilden, Esq., A. C. Trotman, Esq., R. S. Starkie, Esq., and R. B. Warwick, Esq. Application for tickets to be made to the following stewards, who form the committee:—Dr. John Attfield, 18, Beacon Hill, N.; Mr. Thomas Billing, 143, New Bond Street, W.; Mr. Richd. Forrest, 81, Hatton Garden, E.C.; Mr. G. J. Haddock, 338, Oxford Street, W.; Mr. S. A. Letts, 89, Long Acre, W.C.; Mr. T. D. Watson, 18a, Basinghall Street, E.C.; Mr. Henry Smith, Honorary Secretary, 37, Wigmore Street, W. Tickets, including supper, wine, and refreshments during the evening, lady's, 10s. 6d., gentleman's, 15s. Coote and Tinney's band will be in attendance. It gives us great pleasure to draw attention to the above. No pains have been spared to make the gathering thoroughly respectable. Each ticket is countersigned by a steward, who is responsible for the holder, and tickets are only issued to persons who are in some way known to those who have undertaken the management of the affair. It promises to be very successful, and it is to be hoped that it will be the first of an annual series. With a conference in the summer and a ball in the winter, something must be done towards breaking down exclusiveness and jealousy, and establishing a kindly feeling amongst those following a common calling.

Meetings for the Week.

Monday, January 28.

Medical Society, 8 p.m.

Tuesday, January 29.

Royal Institution, 3 p.m. Professor Tyndall, F.R.S., "*On Vibratory Motion, with special reference to Sound.*"

Wednesday, January 30.

Society of Arts, 8 p.m.

Thursday, January 31.

Royal Society, 8½ p.m.

Royal Institution, 3 p.m. Professor Tyndall, F.R.S., "*On Vibratory Motion, with special reference to Sound.*"

Friday, February 1.

Royal Institution, at 8 p.m. J. Scott Russell, Esq., F.R.S., "*On the Crystal Palace Fire.*"

Saturday, February 2.

Royal Institution, at 3 p.m. G. A. Macfarren, Esq., "*On Harmony.*"

ANSWERS TO CORRESPONDENTS.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. 6d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

X.—It was an oversight. The review has not yet appeared.

T. R. O.—The processes directly. The tables when ready. No biographical notice has been published in England.

F. C. S.—The attempt to induce crystallisation of the fused glycerin by the introduction of a fragment of solid glycerin was made, but without success.

T. Jones.—Dissolve standard silver in nitric acid, evaporate, and fuse. Then dissolve in ammoniacal water, and add sulphite of ammonia. On heating, pure silver will be precipitated. Wash this, and dissolve it in nitric acid, evaporate to dryness, fuse, and recrystallise. The product will be pure nitrate of silver.

Phosphide of Magnesium.—We have received a letter from Mr. Thomas P. Blunt, of Shrewsbury, containing an account of further experiments on the phosphide of magnesium, but as they are at present incomplete, and the author has not yet had an opportunity of meeting the charges of inaccuracy brought against him by Mr. Parkinson, the further discussion of the subject must necessarily stand over until the appearance of the forthcoming *Journal of the Chemical Society*, which will no doubt contain the official report of Mr. Parkinson's statements at the meeting of the 6th ult.

Analyses of Phosphates.—A correspondent writes:—"I could mention some awkward facts as to these determinations; perhaps more where five guineas have been paid than where 10s. 6d. or 21s. I have had superphosphates, which could not contain over 30 per cent. total phosphates, and perhaps of this 24 per cent. or 25 per cent. soluble, certified, to my great astonishment, 30 per cent. soluble, and total 34 per cent. Can you wonder if my partner, who is not a chemist, hunts up a '*high*' analyst who is a great authority amongst agricultural clubs, and parades his analysis of 30 per cent. soluble, in preference to one who only gives 25 per cent., the samples being identical in every way?"

Ansell's Fire-damp Indicator.—Mr. Ansell has drawn our attention to a slight error which appeared in our "Answers to Correspondents" for January 4. It was there stated that a full account of the "Indicator," *written by Mr. Ansell himself*, appeared in the Chemical News, vol. xii., p. 280. The article in question was, however, written by Mr. McLeod, and contained many well-merited compliments to Mr. Ansell. This gentleman is, therefore, anxious to disclaim the authorship of expressions which, although they might justly and gracefully be applied to an inventor by an impartial writer, would confer no honour if written by the discoverer himself.

E.K.—The word *teratomic*, which has puzzled you in the "Dictionary of Science," is evidently a misprint for *tetratomic*. The mixing up of Latin and Greek is therefore only apparent. You can have no better book for initiating you in the mysteries of modern chemistry and nomenclature than Dr. A. Wurtz's "Introduction to Chemical Philosophy" advertised in our pages. The temperatures you quote are certainly very low. But was the thermometer trustworthy?

Received.—"A New Chemical Nomenclature," by T. D. Tillman, A.M., New York.

LONDON WATER: PAST, PRESENT, FUTURE.

PRESENT.

Many eminent observers have come to the conclusion that evil effects follow the use of the London water, and notably, according to some, in the production of cholera. This has been inferred from the limited area where the epidemic of 1866 raged at first, being supplied by one London company, and the area was mapped out as being bounded by the supply of this water. But never more than now has water-supply as a cause of epidemic disease been in less favour than at present. These diseases are almost without exception most fatal among the lowest classes, and amongst these the care of separating sewage emanations from the water supply is least provided against. In a district where an epidemic is raging, foul cisterns or butts, without exception, will be found for the storage of water, sometimes for thirty-six hours (from deficiency as regards quantity), communicating with the storage for sewage by a waste-pipe without tap or syphon. Poison is in the sewage, and there is a direct communication between the sewage and water, from defect of local appliances, and where one house is so supplied, the whole street built on the same plan will be only a repetition of the copy.

But it is absurd to compare local defects of supply and storage with chemical analyses made at the spot whence the water is supplied. The evidence of the chemists before quoted shows that the purer the water the more readily will it carry poisonous matters, from the inorganic matters in the water being in a slight degree disinfectant. If, then, with the present water service, at once for sewerage and house supply, an impure water could prove such a fatal vehicle, what would have been the state of affairs if pure soft water had been used? Of course the general introduction of sewage into water must be guarded against, but the local causes, acting in a very limited area, are infinitely more important, from greater concentration and smaller means of oxidation. In a word, do not let us confuse the quality of water as supplied from the filtering beds with that which is actually in household use; let the chemical and engineering bearings of the subject be always carefully separated, and we shall in all probability find, if the water be drunk as it is supplied from the filtering beds, that, except on the score of hardness, the present London water is as wholesome as chemical analysis has proved it to be.

The chemical means of rendering the London water still better, as lately suggested, have more interest when discussed in relation to the future. No one has asserted that the Thames water had anything to do with the late epidemic, and its water is inferior to that from the Lea. The sewage tidal reflux does not probably reach the water, when it is obtained for drinking purposes, in any case; but that from towns on the banks of rivers above such sources would be less thoroughly oxidised in a small stream than a large one. Sir Benjamin Brodie has expressed his conviction that the noxious quality imparted to the Thames water by the sewage of Oxford is not removed by the time this water reaches Teddington Lock. If this were so, the River Lea must be in a dangerous state. But we maintain that such matters should be disinfected by natural and rational means, and their introduction for the future should be provided against. We cannot think that such matters, if present, could escape detection by the present accurate use of potassic permanganate, however fallacious its use may sometimes be. The quantity of oxidisable matter at present in the London water cannot be compared with that existing in 1851, from the fact that the means of testing for it have only lately been applied. The colour of the water has certainly been improved by filtration, but the temperature is still very variable. It has been shown that the Thames supply is almost inexhaustible, and the only reason for its abandonment urged by the Commissioners was the introduction of sewage, which now is being yearly diminished in quantity. The applicability of river water, then, turns upon the sewage question, and on this account the Thames water is a good source for supply, if it be properly used, and there certainly is no reason for smaller and more dangerous streams to be pressed into service while it exists.

SCIENCE AND FIRE-DAMP.

The sciences of chemistry and physics have of late years been so fully under the control of reason, have admitted of such easy application, and made such steady progress, that the public generally look to the masters of them for remedies against evils that continually are arising, whether under an old or a fresh form; and timely remedies have been so often thus supplied, dangers and difficulties have been so successfully, because rationally, met, that it almost seems, with our present amount of knowledge—however imperfect it may be—that a difficulty has only to arise for it to be thoroughly subdued. Numerous colliery accidents that have occurred recently, both in England and on the Continent, arrest, by the wholesale loss of life attendant upon them, the interest of all. A remedy easy of application against any more such has come to be considered as a necessity. In answer to this appeal, M. Somonet, a pupil of M. Austry, proposed to the Academy of Sciences (Jan. 14, 1867) the introduction into all drifts of electrical conducting wires, so that the inflammable gases may be set on fire by interrupting the electric circuit before time has been given for them to collect in dangerous quantity. The plan appears very feasible and simple, and we hope that the suggestion may meet with some notice.

The full import of such a suggestion can hardly yet be appreciated, but it serves as one of the best examples of modern times to show how useful applications fall readily and almost infallibly from researches in the first place of abstract and theoretical value only. Let us not, then, undervalue the powers of theory, but remember with Liebig, that "we value facts because of their permanence and immutability, and because they supply the grounds for ideas; but a fact acquires its true and full value only through the idea which is developed from it."

An Extraordinary Medical Bill.—At the Commissioners' meeting at Cheltenham lately, a letter was read from Mr. Horsley, county analyst, asking for the payment of the sum of three guineas for poisoning sixty-three dogs in the months of July and August for the Commissioners, and by order of the police. It was resolved that, as the police ordered the execution, they should pay the account.—*British Medical Journal.*

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Preparation of Pure Silver, by Professor* J. S. Stas.

(*Concluded from page 27.*)

Second Method.—This method furnishes it easily and more promptly than any other known way; it has the special advantage of giving it in a state of rare purity. I will describe it in detail, as I am convinced that it would be useful in laboratories and in the workshops of the Mint for the preparation of assay metal or *standard* silver.

It is based upon the *complete* reduction which ammoniacal solutions of silver compounds undergo when added to ammoniacal cuprous sulphite, or to a mixture of sulphite of ammonium and any ammoniacal salt of copper.

At the ordinary temperature this reduction takes place slowly with deposition of black, blue, or grey silver, according to the dilution of the liquids. Above a temperature of 60° C. the reduction is almost instantaneous, and the silver is precipitated in a state of division corresponding to the dilution of the liquid; its colour varying from grey to pure white.

This is how I prepared silver by this method.

Silver coin is dissolved in dilute and boiling nitric acid; the solution of nitrate of silver and of copper is evaporated to dryness, and the saline mass fused. This fusion is necessary to destroy the *nitrate of platinum, which is often formed in dissolving silver coin.*†

After cooling, the nitrates are taken up by an excess of ammoniacal water. The ammoniacal solution is left to rest *for forty eight hours.* The limpid liquid is filtered through a double filter of paper, and then diluted with distilled water until it contains no more than *two per cent.* of its weight of silver.

I procured neutral sulphite of ammonium by mixing ammonia with sulphurous acid. To ascertain the quantity of sulphite required for the complete precipitation of the silver from the ammoniacal solution of nitrate of silver and copper, I heated to the boiling point a definite volume of solution of sulphite of ammonium, and I found the volume of the solution of silver and copper which was decolorised by this salt. Experiment has, in fact, proved to me that so soon as the sulphite of ammonium, *sufficiently heated*, is not coloured blue by the cupric oxide dissolved in the ammonia, there remains no trace of silver dissolved in the liquid, because in this case all the copper exists in the cuprous state, the presence of which is incompatible with that of any compound of silver dissolved in ammonia.

The quantity of sulphite of ammonium necessary for the precipitation of the liquid having been determined, I added it to the argentiferous solution, and after being well mixed, it was left to itself for forty-eight hours in a closed glass flask, to prevent the contact of the air. At the end of this time about a third of the silver was reduced at the ordinary temperature, and was precipitated in the form of a shower of crystallised silver, of a greyish-white colour, and very brilliant.

I then put the decanted blue liquid, in quantities of ten litres at a time, in a water-bath at a temperature of from 60° to 70°. The time required to cause the elevation of temperature was quite sufficient for the complete reduction of the silver in solution, and for the reduction of the cupric sulphite to the state of cuprous sulphite; ‡ especially as I was careful to take a sufficient excess of solution of sulphite of ammonium.

The silver being eliminated, I decanted the liquid when cold, and proceeded to wash separately the silver precipitated from the cold and the warm solutions. This washing was performed by decantation with ammoniacal water; it was continued as long as the washing waters were perceptibly coloured blue by exposure to air, or precipitated chloride of barium. I afterwards left the silver for several days in concentrated ammonia, and then washed it in pure water.

If the solution from which the silver is precipitated has been diluted until it contains no more than 2 per cent. of silver, the ammonia left in contact with this metal is not coloured even after several days' digestion. There is no longer any copper for the ammonia to dissolve; it *dissolves silver* instead, for this metal is feebly attacked by the alkali under the influence of air, as is easily proved by evaporating liquid ammonia which has remained several days in contact with turnings of pure silver. This liquid always leaves a black shining mirror of nitride of silver by its spontaneous evaporation.

I prepared silver by this method at four different times, and in the last I operated upon 2500 grammes of silver at once. I have proved that by fulfilling all the conditions I have described, and *especially by carrying the dilution of the ammoniacal solution of the nitrates of silver and copper* to 2 per cent. of silver, we obtain silver of a rare purity. When it was wanted to form the precipitated silver into bars, I fused it with 5 per cent. of its weight of calcined borax containing 10 per cent. of nitrate of sodium, as I mentioned in the case of the silver reduced from the chloride by potassa and sugar of milk. I have also fused large quantities with the oxhydrogen blowpipe in a crucible of pure porcelain, or in a oxyhydrogen gas furnace in crucibles of marble lime.

* Abstract from *Memoirs of the Royal Belgian Academy.*

† I have found by several trials that French silver contains iron, nickel, and traces of cobalt, platinum, and gold.

On the Presence of Thorina in Euxenite, by* M. J. Chydenius.

In a note published in 1861 I mentioned that two specimens of sulphate of thorina, from Mosander's collection, were labelled as having been prepared from *euxenite*. This led me to examine this mineral for thorina. For this purpose I took some specimens from Arendal, in Norway, and after porphyrisation treated them with an excess of hot and concentrated sulphuric acid. The pasty saline mass so obtained was almost entirely soluble in cold water, and the solution on boiling deposited a precipitate formed of acids of the titanic group. The ebullition must be continued for some days to make this precipitation complete. After cooling, the filtered liquid is precipitated with ammonia, and the precipitate redissolved in HCl; to the liquid is added a warm solution of sulphate of potash; the precipitate thus formed contains thorina, ceria (if there is any), together with a certain quantity of titanic and other acids which have remained unprecipitated after ebullition of the dilute sulphuric solution. To separate these acids the precipitate is digested with oxalic acid; the acids of the titanic group dissolve, and a pulverulent residue remains of

‡ The liquid in which the reaction takes place becomes quite colourless if the copper contains neither nickel nor cobalt. If it contains nickel, it takes a slight green tint; it takes, on the other hand, a reddish tinge if there is cobalt in the dissolved metal.

* *Bulletin de la Société Chimique de Paris.*

oxalate of thorina, containing, perhaps, oxalate of cerium. To ascertain its nature I ignited the oxalic precipitate, dissolved it in warm concentrated sulphuric acid, and, after dilution, precipitated with ammonia. This precipitate was dissolved in hydrochloric acid, and the solution treated with hyposulphite of soda, which precipitates thorina, but not ceria. In this case I had a precipitate, which showed that I had been working with oxalate of thorina. The identity of the oxide contained in this precipitate with thorina was also proved by its density = 9·17 to 9·22, and by the analysis of the sulphate. The filtrate contained no other oxides, and consequently the thorina was not mixed with oxide of cerium.

Euxenite from Arendal contains, therefore, thorina, but traces only of oxide of cerium; and the analysis of the mineral (density 4·96) gave the following results:—

Mineral acids (titanic, niobic) . .	54·28
Gadolinite earths (yttria, erbia, terbia)	34·58
Thorina	6·28
Loss on calcination	2·60
	97·74

Euxenite also contains traces of ferrous and uranous oxides.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, January 29, 1867.

We are every day becoming more and more accustomed to the use of the electric light. In a few days, thanks to the initiative of H.I.H. the Prince Napoleon, and the commander of his pleasure yacht, M. Georgette Dubuisson, it will be adapted to a ship for the first time, and also for use at sea; at a later period it will be probably established on board vessels of the first class, and those of ocean transport. On Tuesday evening, in the Bois de Boulogne, at the grand skating *fête*, fifteen electric lights erected for the purpose lit up, *a giorno*, the whole scene of lake, island, ice, skaters, and spectators. The effect was splendid. This lighting up was executed by M. Serrin, and was remarkable for its steady brilliancy, while, at the same time, it was simple, economical, clean, and very powerful. For each of the fifteen batteries there were collected forty Bunsen elements placed in a subterranean chamber which concealed the battery from sight as well as prevented the odour of nitrous gases from annoying the spectators. By the side of this pit there was fixed a pillar, hollow within, through which the wires passed to the platform, solidly and at the same time slightly constructed. On this platform was fixed the electric light established by M. Serrin. It was arranged catoptrically, as in the lighthouses of Havre and Odessa, furnished by the Alliance Company of Paris, and was placed on rails; thus, as soon as the carbon ends were burnt away and the light diminished, the man in charge had nothing to do to renew the splendid light but to push, by the hand, a newly lighted lamp, which instantly supplied the place of the faded one. When this was burned out, another lamp was rolled into its place, capable of burning again several hours. By this arrangement a single additional lamp was sufficient (or a sixteenth one) to conduct the service rigorously carried on, and the interruptions of which were quite imperceptible.

It is high time that we seek to make the electric light perfectly stable and effective to be used in public works in urgent cases. We have already spoken of the immense services rendered by this light in the workshops of the Northern Spanish Railway. Several questions have been addressed to us inquiring about the new machine of Mr. Wilde, of Manchester, which is capable of rendering the electric light more facile and abundant. We have always answered, "*Let us wait for the result.*" The Alliance Company is to receive at the end of April, or in the course of September, its first Wilde's instrument.

One of the persons in the employment of the Alliance Company went to Manchester to receive the machine, but he would not accept it until it had shown a light sensibly constant during six or eight hours in a lighthouse. Mr. Wilde thought that the moment for submitting his engine to this severe test had not yet arrived, and that in this actual model, with a velocity of 1500 to 2000 revolutions per minute, the armature acquired considerable heat, and the light diminished in intensity; consequently, he asked M. Berlioz to wait till the end of March or the opening of the Exhibition of 1867. The same reason has made him defer sending the machine intended for the British Commissioners of northern lighthouses, which is on a smaller scale. In this way practical success is far behind considerable theoretical progress. At present the advantage rests with M. Berlioz, who gives his machines a number of revolutions rarely exceeding 300 per minute, and obtains an absolutely constant light. He is at present occupied at important improvements to the engine, which can double its power and secure its future success.

F. Moigno.

PROCEEDINGS OF SOCIETIES.

SOCIETY OF ARTS.

On the Synthesis of Organic Substances, by Dr. F. Crace Calvert, *F.R.S., F.C.S., &c.*

(Continued from page 19.)

Allow me to call your attention to another series of facts, by which M. Berthelot has also demonstrated the possibility of producing organic substances from mineral elements. The starting point of this series is a gas well known by name to all my hearers. It is called "fire-damp," owing to the fact that it exists more or less in all coal-pits, and that when it is liberated in large quantities, and gets mixed with the atmosphere, it produces a most explosive mixture, the result of which is the destruction of thousands of lives in this country. This gas also bears the name of marsh-gas, from the circumstance that it is a constant product of the slow decay of organic matter. In fact, some twenty or thirty years ago, when a lecturer wished to illustrate the properties of this gas, called also light carburetted hydrogen, as compared with olefiant gas, which is called heavy carburetted hydrogen, his assistant had to proceed, as I have done myself, into marshy districts, and, stirring up the mud, collect the few bubbles of gas that escaped from the swamp. This operation—to collect a gas mixed with impurities—which was far from agreeable when it had to be done in January or December, has been obviated through the progress of chemistry. Some twenty years since Dumas found that when he heated in a retort a mixture of dry acetate of soda with baryta, a gas was generated which was marsh-gas, resulting from the following reaction:—The acetic acid of the acetate of soda unfolded itself into carbonic acid, fixed by the baryta, the remaining element being marsh-gas. But Berthelot has gone a step forward, and he has succeeded in producing fire-damp or marsh-gas direct from mineral elements. He has effected this interesting discovery by passing over some heated copper foils, placed in an earthenware tube, a mixture of two substances—namely, sulphuretted hydrogen and sulphuret of carbon. Under the influence of heat, the sulphur of the sulphuretted hydrogen and the sulphuret of carbon unite with the copper, whilst the hydrogen of the sulphuretted hydrogen and the carbon of the sulphuret of carbon combine together to produce marsh-gas.

This triumph of modern chemistry is most important, for if to marsh-gas you succeed in adding two proportions of water, it will be converted into methylated spirit, or wood naphtha, a substance now extensively mixed with alcohol to manufacture the product called "methylated spirit," so extensively employed in England at the present time in arts and manufactures, and which has been the means of removing the duty usually imposed by Government upon all alcoholic liquors capable of being used as a beverage, and enables English manufacturers to produce a variety of varnishes, &c., and to enter fairly into the field of competition with those countries in which alcohol may be considered a cheap article.

We may proceed a step further, and convert this alcohol of wood, as it is often called, into an acid by a similar process as we succeeded just now in converting the alcohol of wine into acetic acid. Thus, if in a flat vessel is placed a small quantity of wood naphtha, and above it is suspended a watch-glass containing platinum black, or purified charcoal, gradually the vapours arising from the wood naphtha come in contact with the platinum black, and are converted into an acid called formic acid—an acid which can be extracted from the insect called ant, or *Formica*. Therefore, from carbon and hydrogen M. Berthelot has produced not only wood naphtha, but formic acid, the product found in an animal. Formic acid has become, like many other organic substances, a curiosity one day, a commercial product the next. It is now manufactured artificially in large quantities, owing to its successful application in the production of those beautiful tar colours, especially blue, to which we have already referred in this lecture. But the application of formic acid, I think, will not be limited; it will extend widely with time, not only because it reduces with great facility metallic salts, especially those of silver —and thus will, no doubt, become in time the means of silvering glass, instead of having to employ the present costly method.

Whilst dwelling on formic acid, let me call attention to a direct artificial mode of production of that substance, also from mineral elements, by a most skilful process devised by M. Berthelot. All persons must have noticed, on a winter's evening, on sitting before the hearth of a good fire, which has yielded its gaseous matters under the form of flame, and has left a red glowing mass, a fugitive blue flame, which has received the name of oxide of carbon —gas which is, in fact, always produced when oxygen is brought in contact with an excess of carbonaceous mass in a state of incandescence. This blue-burning gas, or oxide of carbon, which is highly poisonous, is the gas chosen by M. Berthelot to produce formic acid. To arrive at this end he pours at the bottom of a large glass vessel a strong solution of caustic lye of soda or potash, filling the vessel with oxide of carbon. After giving a rotatory motion to the glass vessel, the oxide of carbon is absorbed by the potash, and each two chemical proportions of oxide of carbon, in fixing one chemical proportion of water, are converted into formic acid, which unites with the potash to produce formiate of potash or soda. Besides these two interesting discoveries of the production of organic substances direct from mineral elements, M. Berthelot and several other chemists have produced organic acids from other hydrocarbons derived either from destructive distillations of coals or other organic substances. Thus the acid existing in valerian root has been generated from a hydrocarbon existing in petroleum, called amylene. Propyle has been converted into propionic acid, naphthaline into benzoic acid, &c. Further, hydrocarbons which are found existing in the products of the distillation of coals, as well as those existing in petroleum, can be produced artificially by chemical manipulation, and these hydrocarbons are in their turn the centre of a great number of chemical substances, which chemists have succeeded in producing, either adding elements to them, or substituting certain quantities of their hydrogen by other elements, thus giving rise to a new series of products, and thereby a great variety of organic substances.

It will, therefore, be easy to understand how important it is for chemists to be able to produce artificially from one carburetted hydrogen another carburetted hydrogen, and this M. Berthelot has been most successful in accomplishing. By heating, at a high temperature, light carburetted hydrogen, he has succeeded in producing artificially benzine, a substance now so extensively employed, as I have told you in some of my former lectures, in producing most of the tar colours now used in trade. He has also obtained naphthaline by the same means; and you will perceive by the following tables that it is simply necessary to add to a carburetted hydrogen, say equivalent proportions of carbon and hydrogen, to convert it by successive addition into a series of hydrocarbons, susceptible in their turn, by means of oxidisation and other chemical action, of being converted into acids and other products:—

Ethylene . . .	$C_1 H_4$
Propylene . . .	$C_6 H_6$
Butylene . . .	$C_8 H_8$
Amylene . . .	$C_{10} H_{10}$
Caproylene . . .	$C_{12} H_{12}$
Œnonthylene . . .	$C_{14} H_{14}$
Caprylene. . . .	$C_{16} H_{16}$
Ethylene	$C_{32} H_{32}$
Cerylene	$C_{32} H_{32}$
Melissene	$C_{60} H_{60}$

Or,

Marsh-gas or formyl . .	$C_2 H_4$
Hydride of acetyl . .	$C_4 H_6$
,, propyl . .	$C_6 H_8$
,, butyl . .	$C_8 H_{10}$
,, ralyl . .	$C_{10} H_{12}$

The eminent Dr. A. W. Hofmann has succeeded in producing, of late years, a great variety of organic substances, by substituting for the hydrogen which enters into the composition of ammonia or hartshorn (composed of three atoms of hydrogen and one atom of nitrogen) some of the above carburetted hydrogen, thus giving rise to a most interesting series of products, many of which in time will become extensively employed in arts and manufactures. I cannot leave this part of my subject without mentioning the names of Drs. Frankland and Williamson, Messrs. Duppa, Church, Wanklyn, Perkin, and Foster, among our English chemists, who have the most contributed to the progress of organic chemistry by their successful researches in reproducing artificially organic substances, on some of which I shall have the pleasure of dwelling fully during this course of lectures. There are other discoveries not less interesting, but which are in themselves too abstruse, and which involve too many scientific data, to justify me in bringing them before you in addresses intended for general readers, and not especially for a particular branch of professional students.

The lecture was concluded by illustrations with apparatus, and giving an outline of the methods followed by chemists to determine the elementary composition of an organic substance. Without entering here into all the details of manipulation necessary, and a description of the apparatus used for ascertaining these compositions, we may state that the purpose of these operations is to determine the exact quality of carbon charcoal, and the exact proportion of hydrogen gas which exists in 100 parts of an organic substance. This being determined, the figure necessary to reconstitute the 100 parts of the organic substance employed is represented by oxygen, and it is easy to calculate, by employing chemical equivalents, what is the formula which that organic substance should have. To determine the amount of carbon and hydrogen in the substance, it is placed in a tube, and after being carried to a red heat it is subjected to the action of

oxygen, either employed as a gas, or in contact with a substance, such as oxide of copper or chromate of lead, which yields oxygen with facility. The result is that the carbon is converted into carbonic acid, which is absorbed by alkali, and its amount accurately determined, and the hydrogen of the organic substances is converted into water, which is condensed by means of oil of vitriol, and also its proportions accurately ascertained. With these data it is easy to determine the number of atoms of hydrogen, carbon, or oxygen which exist in organic substances. As to organic substances which contain nitrogen, the proportions of this gas in 100 parts of the substance submitted to elementary analysis is determined either by collecting it as a gas, and from its volume calculating the amount in the substance, or it is converted into ammonia, which, in its turn, is absorbed by sulphuric acid, and its amount also accurately ascertained. By these methods the amount of nitrogen in the organic substance is known.

ACADEMY OF SCIENCES.

January 28, 1867.

(FROM OUR OWN CORRESPONDENT.)

NOTE accompanying the presentation of a map entitled, "*Ethiopia, No. 3: Simen et Zimbila,*" by M. Antoine d'Abbadie. The interest of this map is concentrated in the Simen, a mass of trappic formation interspersed with numerous precipices, some of which are of vast depth, and expose basaltic columns in several points of their bases. The culminating point of this chain is the mountain Ras-Dagan, which attains a height of 15,138 feet, about 659 feet lower than Mont Blanc. This is the most elevated point in the African mountains ascended by a European traveller; the low latitude explains this, being only 13° 14′ N. The snow rests on the summit for a very short period of the year, and none remained on the surface during the visit to the highest point by M. d'Abbadie on May 15, 1848. The slopes of the massive chain are so abrupt that the valley, of the length of nearly five miles, between Sawada and Jucatkab presents a unbroken line of precipices 2624 feet high. At the north-east, on the slopes of the Buahit, several of the companions of M. Abbadie died of cold on October 3; whilst at the ford of Takkazi, at 120 kilometres further off, at an altitude of 3071 feet, a thermometer laid on the ground marked a temperature of 70° C. This map is the eighth that he has published of Ethiopia. Two other maps and an index-map will complete the *ensemble* of the positions that the author has determined by expeditious geodesic measurement, as well as by details and sketches collected on the spot.

M. Abbadie purposes publishing at a future period a general map of Ethiopia, on which he will add to his series of positions all the results of the labours performed by the European explorers, and all the information that can be obtained from native travellers who have supplied him with data upon the neighbouring countries remaining unknown up to the present time to our geographers.

M. Emile Blanchard, in presenting a memoir "*On the Heart of Insects and Mollusca,*" by M. Alexandre Brandt, published in the *Bulletin of the Academy of Sciences of St. Petersburg*, remarked that the author had particularly in view in this paper to demonstrate that the motions of the heart in insects and certain mollusca are not determined in any way by the extrinsic muscles. The pulsations continue with the same intensity during a certain time after that organ has been completely isolated.

M. Peligot communicated, in the name of M. Kessler, the following:—Some years ago M. Kessler introduced into the manufacture of crystal glass the process of engraving by hydrofluoric acid, employed upon a resinous coating, deposited mechanically by means of a stencilled impression on paper. This is the process employed at Baccarat, Saint-Louis, in the factory of M. Maréchal at Metz, &c. At its origin the engraving was done transparently; since that period it has been successfully used in giving a dull surface.

MM. Tessié du Mottay and Maréchal, jun., have composed alkaline fluoride baths with the addition of acids now employed in the manufacture of crystal glass. They attribute the formation of the dull surface to the insolubility of the fluorides of lead and calcium. M. Kessler states and proves that, on the contrary, the salts employed give rise to fluosilicates of imperfect solubility, which become solidly attached to the glass in the form of minute granular crystals, and act as a finely disseminated coating. The result is that the surface of the glass presents inequalities, having the appearance of fine sand. If the adherent deposit is not crystalline, or if the crystals are too small, there is no dull surface.

Finally, M. Kessler has succeeded in composing, with fluorhydrate of ammonia and hydrochloric acid, properly thickened, an ink with which, with any pen, ineffaceable characters can be traced on the glass, thus rendering great service in laboratories for labelling bottles and correcting the divisions of areometres, densimetres, &c.

M. Chasles presented to the Academy a copy of the work by M. de la Gournerie, entitled "Researches on Symmetrical Tetrahedral Regular Surfaces." It consists of three memoirs, on which a report had been already made by Messrs. Chasles and Bertrand. The author had also taken measures for the printing of the work, to which he had to add some further developments. For this reason, as the commission stated, the insertion in the *Receuil des Savants Etrangers* was not demanded. The work certainly contains many new developments, and four notes by Mr. Cayley. M. de la Gournerie explains in the following passage how he had obtained the co-operation of our celebrated correspondent:—"Some weeks after the publication, in the *Comptes Rendus*, of extracts of my two first memoirs, Mr. Cayley was kind enough to congratulate me thereupon, and to communicate to me some very elegant equations on the surfaces that I had made known. This step taken by the celebrated geometrician impressed me with a deep feeling of gratitude, and it led to a correspondence between Mr. Cayley and myself, which was of great interest to me. Mr. Cayley sent me for this work a note, in which are reproduced some details of his first communication. He, moreover, authorised me to dispose of his letters as I wished, and I have extracted three fragments, which I present under the form of notes."

M. Gustave Lambert, hydrographer attached to the French marine service, made a communication "*On the Laws of Isolation.*" It referred to the temperature of the zones of the boreal regions, or to the power exerted by the diurnal isolation of the sun, the principal cause of this temperature. The power of isolation in a certain place ought not to be confounded with the thermometric effect which is its consequence, but which depends upon a number of variable causes analysed by the author, and of which the technical details have been sent in an extended memoir upon isothermic lines, &c., &c. Designating by L the heliocentric longitude of the sun, w = the obliquity of the ecliptic, w' = the angle formed by the axis of the earth with the circle of isolation, an angle which is equal to the declination, l = the latitude, we have the following equations to represent the graphic *trace* of the curve of isolation at each parallel and at each season:—

$$\text{Sin } w' = \sin w \sin L$$
$$x = L \cos (l - w')$$
$$y = L \cos (l - w') \tan w' \; Sw \; (l - w')$$

in which x represents the power of the diurnal isolation.

M. Edmond Becquerel, on the part of Messrs. Pouillet and Babinet, made a report, completely favourable, upon a memoir presented by M. F. P. Leroux, on August 20 last entitled "*Theoretical and Experimental Researches on*

Thermo-Electric Currents." In a long and important work the author had stated and verified a great number of new laws, and given the explanation of a great number of mysterious phenomena. He was led to the conclusion that each body possesses *à priori* an electric tension measured by a function of the identical temperature for all bodies for each of them; that thermo-electricity is a property of matter, and not an accidental occurrence in bodies; that the conception of absolute electric tension, as a function of the temperature, is destined to account for atmospheric electricity, and to solve the difficult question of the pre-existence of chemical or electric action, thus affording a great progress in the identification of heat and electricity. The commission notes, wich all reserve, the theoretic views undemonstrated by practical experiment. But it asks the Academy to thank the author in the warmest terms, and to recommend him to prosecute his studies, inserting the first memoir in the *Recueil des Savants Etrangers*, one of the greatest honours he could receive.

M. Delaunay presented the first copy of the 29th volume of the *Mémoires* of the Academy, devoted entirely to his theory of the moon. This is the second part, of which the first appeared in 1860. Immense formulæ, interspersed with some lines of text here and there; that is what is in store for the very few—nay, rare—readers of this gigantic work, irreproachable in an algebraic point of view. M. Delaunay cordially thanked the Academy, and he had good reason to do so, since these volumes have cost them the fabulous sum of 1000*l.* to 1200*l.* As a *chef d'œuvre* of typography, it reflects great credit on the printing establishment of M. Gauthier-Villars and M. Bailleul, under whose direction the work was impressed. M. Delaunay had at first carried his calculations as far as terms of the seventh order; later he found that they must be pushed up to the eighth and even to the ninth degree. It appears, however, that this is not enough, since a geometrician very timid, but of an excessive delicacy, M. Puiseux, has followed in the same track as M. Delaunay, and gone much further, in not supposing any more fixed ecliptics, and in taking into account the changes which the elements of the sun are liable to. We frankly avow that the presentation by M. Delaunay himself of the memoir of M. Puiseux seems to us in point of view of the theory of the moon to be a veritable suicide; inasmuch as he casts a doubt upon, or calls into question, all the conclusions of his vast store of formulæ.

M. Leverrier stated that the learned Director of the Marseilles Observatory, M. Stephan, had discovered, on Tuesday, January 22, a telescopic comet, of which he could not determine the position till Friday evening. Right ascension, 2h. 34m.; North Polar distance, 74° 26′.

M. Delesse presented a memoir on his researches upon the littoral deposits on the shores of France made during the last few years. He finds that they present a very varied mineralogical composition at the level of high water, because they contain the *débris* from adjoining shores, but that at the level of low water the structure is much more uniform. At the bottom of the ocean it remains constant over a great extent. Thus, whatever be the nature of the rocks contributing to the formation of the deposit, the sea is not slow in destroying them; and we find everywhere the minerals, which have escaped from its action, either by their hardness or their unalterability. Of all minerals deposited by the sea at low water mark, the most widely spread is hyaline quartz. This is explained by its hardness and abundance.

NOTICES OF BOOKS.

Buckmaster's Physiology. London: Longman and Co., Simpkin, Marshall, and Co. Dublin: Ward and Sullivan, 27, Marlborough-street. 1866.

We notice this useful school book, not because it is about physiology or appropriate for review in the Chemical News, but simply as being worthy of insertion amongst the curiosities of literature. "Buckmaster's Physiology" is written by Mr. John Angell, and published by two eminent London firms, and also by one at Dublin. There is no clue given to us of who or what Buckmaster is, or what connexion he or it has with the book. We do not know anything of a series of works bearing the name of Buckmaster either. The whole is a complete puzzle, and we should welcome an explanation of it from the author or publisher.

On the Results of Spectrum Analysis applied to the Heavenly Bodies. By William Huggins, F.R.S., F.R.A.S. London: W. Ladd.

This is a reprint of a discourse delivered by Mr. Huggins, before the British Association, at Nottingham, in August last, and is now published in a separate form, illustrated by eighteen photographs of the most interesting spectra, and of the apparatus with which they were observed. The author's reputation is sufficient to vouch for the correctness of his observations, and the conclusions he draws from them will show to what extent our knowledge has as yet been increased by this, the latest addition to the science of astronomy.

CHOLERA AND ANTISEPTICS, 1866.

(A) *The Arrest and Prevention of Cholera; being a Guide to the Antiseptic Treatment.* By A. E. Sansom, M.B. Lond. London: Churchill.

(B) *Asiatic Cholera.* By F. A. Burrall, M.D. New York: Wm. Wood and Co. London: Stevens Bros., Covent Garden.

(C) *Reprint from the Appendix to the Third Report of the Cattle Plague Commission.* By Wm. Crookes, F.R.S. London: J. H. Dutton, 1, Wine Office Court, Fleet Street.

(D) *Tenth Annual Report of the Medical Officer of Health for the Holborn District Board of Works, London.*

(E) *Handbills relating to Precautions to be taken against the Cholera.* Various.

(*Concluded from page* 8.)

As regards cholera, at present we can only mention its predisposing causes as those of zymotic diseases in general, but cannot yet place it in a more perfect class—*i.e.*, where there exists a predisposition to it specially, and not to any other zymotic disease.* Dr. Gibbons, writing after the ravages of cholera, calls attention to the necessity of this discrimination, in order that proper remedies may be applied, and means of prevention to be used against the recognised *causes* of disease should possess special interest to chemists, who have already done such good service.

"The Legislature and Boards of Health, in dealing with the unhealthiness of towns, have restricted their attention too exclusively to the prevention of epidemic disease. Not but that some of the measures prescribed and adopted, as the ventilation of dwellings and public buildings, do tend to mitigate the ravages of consumption and other tubercular diseases. But I think the prevention of the tubercular class will require a different description of measures from those which have proved to be serviceable against diseases of the epidemic class" (Dr. Gibbon).

Dr. Sansom throughout his book shows plainly with what advantage a knowledge of chemistry may be applied as a means of prevention of disease.

So much for cholera generally as connected with other diseases by certain causes. As regards the actual cause

* The importance of these theoretical considerations cannot be overestimated as regards rational and systematic disinfection. Thus, given any zymotic disease, if it be endemic remove the cause, if epidemic disinfect.

of the disease, Dr. Sansom professes himself an advocate of the theory of its causation by distinct organised germs transmissible from place to place, and arguments for this are very abundant. We will quote only a few.

Dr. F. A. Burrall writes:—"If a ship laden with poisonous serpents should stop on its passage at different ports where no such reptiles existed, and soon after its arrival these venomous creatures should be observed in those ports, the natural inference would be that they had been brought thither by that ship, and it would not be a sufficient reason for disbelieving it that in some other ports touched by the same vessel no such reptiles had subsequently made their appearance."

Pettenkofer says: "Without the least danger of making an error, we can assert that the substance in question (the ultimate cause of cholera), although quite unknown to us as a separate entity, must be of organic nature, and either a cell or a ferment."

So far the cholera has been shown to resemble in its cause the cattle plague and the epidemic diseases; the opponents of the theory of this causation must consider by their view cholera and cattle plague to be endemic in Britain, which is very doubtful. Speaking only of virulent Asiatic cholera, we think that it is sharply separated from diseases endemic amongst us; and even were we to admit that bad drainage, &c., might *per se* cause typhoid fever, we could not admit the same cause for cholera on general evidence. How does this poison spread?

"The labours of Pettenkofer, Snow, Delbrück, Budd, Griesinger, and others, have shown that the dejections from cholera patients, or those suffering from cholera diarrhœa, are a very frequent, and, as they claim, the chief cause of the propagation of the disease."

"The specific germ transmissible by human intercourse is the ultimate cause of cholera; it is transferred principally in the dejections of those suffering from choleraic diarrhœa, perhaps, also, by persons in good health coming from infected districts."

"In one instance, at Constantinople, the clothes, mattresses, &c., of the sick were washed at the fountain, and the water-pipe being unfortunately broken, the foul water communicated with the clean. In a single day sixty people died at Tatavola, which is a small portion of the city supplied by the infected stream."

From facts and opinions such as those Dr. Snow makes the following statement; we again quote from Dr. Burrall's work:—

"The poison itself is exclusively contained in the intestinal excreta of the infected person, that is in the vomit or dejections; there is nothing from the lungs or skin that produces the disease. This poison is not a gas or vapour, but a substance capable of existence in the fluid or dry form of matter; hence it can only be wafted a little way by the air, and when in the dried state can only be carried long distances by being attached to articles of clothing, or disseminated by the agency of water."

This is very generally believed at present to be a just expression of the facts known, as we know nothing of any other probable means. The same author, Dr. Burrall, further on asks if the poison may not be a gas or vapour, in the following words:—

"Is it safe to assert that the poison is exclusively contained in the intestinal excreta, or that it is not gaseous or a vapour, when it is so subtle as to have eluded the most searching examinations? Some points in this theory seem to be substantiated, as that the poison is (mainly) contained in the excreta, and that it may be carried on clothing or food; hence it is better to admit what is known, and patiently follow the teaching of facts in a further elucidation of those features of the disease which are as yet unknown."

But how do these reasons apply to the truth of the proposition? We compare with them the following extracts from the Cattle Plague report:—

"There are weighty reasons for deciding that the infecting matter is neither a gas nor even a volatile liquid. The almost infinite attenuation which a gas undergoes, owing to its rapid diffusion into the atmosphere, would render its supposed noxous influence imperceptible a few yards from the focus of infection. Moreover, the infection is capable of being carried considerable distances in clothing or running water, and in a variety of ways incompatible with the behaviour of gases. For these reasons, and many others unnecessary to adduce here, it seems clear that the disease must be communicated by the agency of solid, non-volatile particles."

Again, "There is no difficulty in admitting that the infection may travel for a certain limited distance through the air, and it is even likely that it may be carried longer distances by fogs, or heavy vapours, or by the gases of putrid decomposition; but it appears in the highest degree improbable that the germs should be able to retain their vitality for any length of time in the atmosphere."

If the view of its being carried by clothes and the person be admitted, then the disease is contagious in the limited sense of the word, as well as infectious, and this view seems to be held pretty generally now by physicians, and has the high sanction of Velpeau. "M. Velpeau considers the contagious character of the disease proved to a certainty, and the same is true of other prominent European physicians." (Burrall.)

Another cause for the rapid spread of the disease is pointed out by M. Worms, but fortunately many facts are not to be adduced in proof of his statement, from the early burial of the dead. M. J. Worms states that "the corpses of cholera patients emit the toxic agent in a greater degree than the bodies of the sick." (Burrall.)

With such statements and authorities, we may well rationally place our main reliance on antiseptics for the arrest of the spread of cholera, with a speedy interment of the dead, and, as Dr. Lankester recommends, more especially isolation of the sick, if merely for the prevention of concentration of poison where it cannot be properly rendered harmless by disinfection.

Having drawn these conclusions as regards preventive measures, it only remains for us to notice a subject before hinted at when dealing with the lessons taught by the cattle plague. Antiseptics have been recommended in the report as being of *both preventive and curative* value. The series of experiments bearing on the former were complete, that bearing on the latter were interrupted. As regards antiseptic prevention, we have accompanied all the authorities quoted, but for the conclusion of the subject we must follow Dr. Sansom, who has adopted a curative treatment which depends on internal disinfection, the only author that we know of who has carried out this plan of treatment. At University College Hospital during the last autumn, many cholera patients were treated by external applications only, while the spread of the disease was prevented by the free use of carbolic acid. It was a striking fact that the mortality under such treatment was certainly not more than in the class of cases there and elsewhere treated by internal remedies. Thus, the spread of the disease was prevented, and the more urgent symptoms were relieved. Dr. Sansom goes a step further, as we have before stated. As he argues, antiseptics are preferable to oxidising agents externally, so why not the same internally? In other words, sulphites and carbolates as opposed to chlorides (calomel also causing a flow of antiseptic bile by specific action), tannates, &c., &c. Thus, at page 116 he writes:—

"We have two agents which fulfil the indications which we require to render inert an organised poison: 1, the sulphites; 2, carbolic acid. These have their mutual advantages and disadvantages. The first is administered with greater facility, but is the more rapidly metamorphosed into other less efficacious compounds, and no doubt has less powerful action upon the germs. The

second, on the other hand, has a 'stinging' effect on sensitive surfaces, and its taste is to some people disagreeable. Happily, having the two agents, we can in great measure neutralise the objections."

But the author in his treatment prefers the sulphite of soda, as being more manageable, perhaps from the quantity of soda salts in the serum of the blood, and so more immediate action — apart from that, sulphurous acid proper. At page 120 we find "The treatment of cholera by doses of carbolic acid has been tried, and though it is as yet, *sub judice*, the reports from the *Belleisle* hospital ship state that it would appear that 'the carbolic acid system had been most successful.' The advantage of carbolic acid is that it can not only be administered by stomach and bowel, whereby it acts upon the organic matter in the alimentary tract, but it is most undoubtedly absorbed into the blood, and, moreover, being a volatile body, its vapour can easily be introduced by the lungs."

One drop of carbolic acid is given by Dr. Sansom with three drops of chloroform in gum-water. We do not learn whether or not carbolates or sulpho-carbolates of soda have been tried without the addition of chloroform, but the more soluble the salt the better. A sodium salt would be assimilated more easily by the serum of the blood, which seems the more affected of the blood constituents. The potash salts may be more soluble, but those of soda should first be tried, if by their means sufficient acid be introduced into the blood.

The author, in addition, advances a theory of the action of the poison germ, which it would be out of place to notice here. We may say that it is scientifically argued, and is certainly worthy of a place with other theories worked out in a similar manner. The more we get of them the better will it be for medical science. We can recommend Dr. Sansom's work as being an excellent example of what original research may effect, even when the subject has been treated as fully as "cholera" has; and Dr. Burrall's book we may also offer as an example of a careful and guarded expression of all that has been said of Asiatic cholera during the present and former epidemics in the smallest possible space. We hope that all the books and pamphlets that we have cited (to use the words of Dr. Sansom) "will receive the friendly criticism of all who desire to discover the most truthful answer to a momentous question."

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Annalen der Physik und Chemie, von Poggendorff.

1866, No. 11.—A. Wullner "*On the Tension of the Vapours of Mixed Liquids.*"—A. F. Sass "*On the Composition of the Water of the Baltic in various parts of that Sea.*"—F. C. Henrici "*On the Quantity of Water Retained by Divers Kinds of thoroughly Moistened Soils.*"—R. Schneider "*On Selenide of Bromium.*"—W. Muller "*On the Diminished Reductive Activity of Hydrogen Gas on being Diluted with Divers Chemically Indifferent Gases.*"—Sandberger "*On the Transformation of Calcspar into Arragonite.*"

Annales du Génie Civil.

Paris, December, 1866.—"*On Chloride of Sodium,*" by Henri Berge.—"*On Asphalte,*" by Leon Malo.—E. Kopp: "*Review of Practical and Theoretical Chemistry.*"

Annales des Mines. 6th series. Vol. IX. 3rd part. 1866.

"*Report to His Excellency the French Minister of Public Works on the Means of rendering Industrial Pursuits in France more Healthy to Workpeople.*"

L'Invention. No. 12. 1866.

"*On Engraving on Glass and Crystal by Chemical Means.*"—"*On the Causes of the Exhaustion of the Soil on which Vines are Cultivated.*"—"*On the Manufacture of Champagne Wine.*"

Journal of the Royal Dublin Society. No. 35.

Dr. Barry "*On Submarine Volcanoes and on Earthquakes.*"—Hoare "*On the Resources of the Sea Fisheries of Ireland.*"

Künst und Gewerbeblatt der polytechnischen Vereins von Bayern. October, 1866.

"*General Police and Safety Regulations ordered in Bavaria for the Keeping, Storing, and Transport and Working with Refined or Unrefined Petroleum.*" — Dr. Bernhardi "*On Bricks Made and Burnt from a Mixture of Lime and Sand.*"—Pelouze "*On the Composition of Raw Soda.*" — Heinsius "*On a Petroleum Lamp constructed so as to Prevent Explosions and Danger from Fire.*" — "*On Extract of Malt.*" — "*On Glass Frames specially made to Protect Plants placed in Hothouses from the Scorching Effects of the Sun's Rays without excluding Light.*"

Le Génie Industriel. December, 1866.

"*On a Mortar Impervious to Water and Resisting the Effects of Rain.*"—Pitancier "*On an Artificial Manure fit to Supersede the Use of Peruvian Guano.*"—Savalle "*On Apparatus to Distil and Purify Alcohol more effectually and at less Expense.*"

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3304. W. E. Newton, Chancery Lane, "Improvements in welding steel to malleable iron, and tempering the steel by one and the same operation, and in tempering steel after it has been welded to iron." A communication from A. R. Reynolds, Auburn, New York, U.S.A.

3307. C. E. Brooman, Fleet Street, "Improvements in the preparation and appplication of certain fatty bodies." A communication from M. Paraf-Javal and E. Paraf-Javal, Paris.—December 15, 1866.

3311. H. Hall, Stacksteads, near Manchester, "Certain improvements in the preparation of size, and in apparatus connected therewith."—December 17, 1866.

3326. L. Schad, Warrington, Lancashire, "Improvements in treating aniline colours for dyeing and printing."

3327. W. R. Lake, Southampton Buildings, Chancery Lane, "An improved mode of rendering paint uninflammable." A communication from J. B. Harris, Germantown, Kentucky, U.S.A.—December 18, 1866.

3354. W. E. Newton, Chancery Lane, "Improvements in effecting the combustion of substances in a pulverulent state." A communication from A. V. Olivier, Rue St. Sebastien, Paris.

3355. A. V. Newton, Chancery Lane, "An improved compound for coating ships' bottoms and other surfaces." —A communication from C. J. Eames, New York, U.S.A.

3359. C. Norrington, Plymouth, "Improvements in the treatment of substances containing phosphate of lime."—December 20, 1866.

3386. H. A. Dufrené, Rue de la Fidélité, Paris, "Certain improvements in the manufacture of the extract of madder." A communication from J. Pernod, Rue des Cles-Avignons, France.

3388. J. Toussaint, Barnsbury Road, Islington, Middlesex, "Improvements in the manufacture of cement."—December 24, 1866.

3401. W. Bradburn, Wednesfield, Wolverhampton, "Improvements in treating excrementitious matters and other refuse matters for the purpose of obtaining valuable products therefrom, and in apparatus to be employed for that purpose."

3411. H. B. Condy, Battersea, "Improvements in the manufacture of chlorine, and in preparations for evolving chlorine for disinfecting and other purposes."—December 28, 1866.

3419. H. Chamberlain, Wakefield, Yorkshire, "Improvements in the manufacture of coke and charcoal, and in the ovens employed therein."

CORRESPONDENCE.

Ansell's Fire-damp Indicator.

To the Editor of the Chemical News.

Sir,—It is funny that a correspondence conducted in another paper should be imported into your columns. "Don't Blow Up" seems to be really desirous of information. He is, therefore, different from the other correspondent, whose only object was to "pay me out" because I would not reply to some of his stupid letters. To that man I again say "simply untrue," because he wilfully misrepresented.

The untruth to which I took objection rested on the fact that the writer of a paragraph had for his own purposes jumbled up the facts connected with two instruments intended for different purposes. He says, "It is possible, and even easy, with an Ansell's indicator, constructed to give an indication at any given point (say 5 per cent. of fire-damp in two minutes, for example), to change the atmosphere in which it is placed from pure air to pure fire-damp without any indication being given. It would be simply necessary to place the indicator in a box of pure air, and introduce (say) 3 per cent. of fire-damp every five minutes." Supposing that I am required to meet this case, I should use a thin slab of marble one-eighth of an inch thick, and so give the warning in two minutes or less, and by the same instrument show the gradual increase with perfect certainty. The writer did not accept my invitation to come and see because he did not wish to be convinced, and had he been convinced would not have adjusted his misrepresentation. That writer says further on, "But unfortunately the very principle upon which the invention is based has compelled practical men to demand the complete demonstration of the contrary before admitting that its introduction into collieries would not lead to increased danger," &c. To this untruth I reply that no such demand has been made; while, on the contrary, I have practically demonstrated the truth of all my statements to the entire and expressed satisfaction of bodies of mining engineers in various districts, who were invited to meet me by Mr. J. W. Day, the secretary of the Mining Association of Great Britain, and who purposely selected such pits and places as would present, in Mr. Day's own words, "every difficulty likely to occur in coal-pits." The engineers who accompanied me never once asked other demonstration, They invariably said, "Well, Mr. Ansell, if fire-damp be present you show it by your instruments, but we know fire-damp is there; tell us how to get it out."

In replying to my comment on the paragraph above alluded to, the editor of the *Mining Journal* says—"In the table of experiments included in that paper, Mr. Ansell notes a case in which he thinks that the indicator did *not* indicate correctly, and gives the alarming statement, by way of excuse, that 'it was agreed that this was held ten seconds too long, as the index had travelled backwards.'" In reply to this, I would say that the untruth is in the intention of the writer, not in the words he uses. He has to bolster up a rotten case. The simple fact is, that when I was at Wigan Mr. Gilroy had taken down the pit with us a collier, whom he believed to be specially intelligent, and who really was beyond the average in that respect. On the day following the public trial I had occasion to go to Mr. Gilroy's drawing office to fetch some apparatus, because Mr. Gilroy had arranged a private trial for the benefit of his underviewers, and there I found the intelligent man of whom I have spoken actually with coal-gas practically demonstrating by experiments my invention to firemen, clerks, and colliers—in all about twelve. I listened with no little interest to his lecture; it was without fault; but he could not understand *effusion*, and called it incomprehensible. The result was that I showed him, and he afterwards went to the pit with the rest of us; and there, after our experiments had satisfied everybody, I practically showed the man that by holding the pocket indicator too long, the hand would travel backwards; and of course it did so. Seeing this, the man said, "Then it is really necessary to hold that particular instrument exactly as long as you tell us, just as it is to take eggs out when they are boiled?" It was thought well to insert these two experiments, else cavillers would say they were not all put down. But Mr. Baldwin said to the gentleman who wrote down facts—"Write 'It was agreed that this was held ten seconds too long,' and *that will make it fair to Mr. Ansell.*"

Here is another proof of the untruth of the writer—that, to bolster up his absurd statements, he lugs in another instrument than the one he was before criticising.

If the article which you so kindly inserted be read with this letter, I feel sure that the whole matter will be quite transparent. I am, &c. George F. Ansell.

Royal Mint, January 24.

P.S.—This letter is deliberately written, notwithstanding its apparent ill-nature.

Determination of Phosphates.

To the Editor of the Chemical News.

Sir,—The letter of Dr. F. W. Griffin, in reply to "A Smatterer," relative to the determination of phosphates in commercial analyses, while entering into some of the causes of the discrepancies between the results of different analysts, fails to explain why the precise disagreements pointed out should exist, though, indeed, the Doctor seems to take it for granted that they do exist.

"A Smatterer" says that "when samples of superphosphate, which contain the highest percentage, say 35 to 38 per cent. of soluble phosphate, and 2 or 3 of insoluble, are analysed by two different men, a 'high' and a 'low' analyst, we get similar reports; but with about 25 per cent. soluble the difference is constant, viz., 2 to 2½ per cent." Upon this Dr. Griffin remarks that "the discrepancies adverted to by the writer can scarcely be obviated, whilst a full analysis is expected for an inadequate fee." Now, "A Smatterer" evidently does not allude to discrepancies exhibited by full analyses, but only those between two different determinations of soluble phosphate. Moreover, he does not state, or give us to understand, that the partial analyses of which he complains were performed "for an inadequate fee." On the contrary, being a manufacturer of "several years' experience," he could not well be capable of offering to a professional man an amount which he must be well aware would not repay the latter for the necessary care and trouble bestowed on such analyses. Besides, if the cause of these discrepancies was "an inadequate fee," why should the "high" and "low" analysts send in similar reports in the case of superphosphates containing from 35 to 38 per cent. of soluble phosphate, and only differ when the sample contains about 25 per cent. soluble, and then, mark you, by a constant quantity, viz., 2 to 2½ per cent?

For my own part, if the discrepancies alluded to by "A Smatterer" really existed as a general rule—and I

am inclined to think that they are merely the results of his particular experience—they might be accounted for by supposing that when samples containing the highest percentage of soluble were submitted to analysis, both "high" and "low" analysts employed the most accurate process at their disposal, and therefore got the same results. On the other hand, when ordinary samples, containing about 25 per cent. of soluble, are analysed, we may suppose that the "high" and "low" analysts employ two different processes of a simpler and more expeditious, though less accurate, character, and therefore obtain results differing by a constant quantity.

This is, however, only one mode of accounting for "A Smatterer's" observations, supposing them to be of a general character, but I can only say that these observations do not agree with the results of my ten years' experience as an analyst of superphosphates.

I am, &c.

John Newlands, F.C.S., late Professor of Chemistry in the City of London College.

Laboratory, 19, Great St. Helens, E.C., Jan. 14.

On some Facts seemingly Overlooked in the late Explosions in Coal Mines.

To the Editor of the Chemical News.

Sir,—While reading over the evidence tendered at the inquest at Barnsley at various times, but more particularly on Monday, the 21st instant, I was very forcibly struck by the absence of all mention being made of the power which quick or slaked lime possesses of absorbing from the atmosphere, and thus rendering harmless, the carbonic acid (after- or choke-damp) which is produced in such abundance by these explosions, and which acts so deleteriously on human life. No mention either is made of the mixture proposed by Professor Graham of slaked lime and crystallised sodic sulphate (Glauber's salt), for use in atmospheres containing this gas, to be put in a cloth and placed over the mouth and nostrils, as a medium through which the air in such places may be breathed without any bad effect, the lime absorbing the carbonic acid.

These points, I consider worthy of notice, as they may serve, to some extent, to lighten the effects of these explosions; and, even though explosions do not occur in all mines, it is well known that carbonic acid is one of the invariable products of respiration, both of man and animals; and also that the gas escaping from the blowers does not always consist of marsh gas alone, but variable mixtures of fire- and choke-damp, and perhaps sometimes solely of the latter. It therefore follows as a natural result, that if quick or slaked lime be exposed in trays or in any other form to the draught of air through the mine, and also in the workings, both old and new, the air will be purified to a greater or less extent from this noxious ingredient, and rendered more wholesome to the miners.

Then, again, I think the decision of the engineers assembled to discuss and decide with respect to the mode to be adopted for putting out the burning coal in the Oak's pit may reasonably be called in question, as to its being the best that could be employed under the circumstances. It is evident from the statements in the papers as to the rubble which was thrown down the shaft, that, before the remainder of the bodies can be got at, or the mine ventilated, this heap of rubble will have to be removed; and not only so, but it is possible, as stated in the extract given below, that on air being allowed to pass through the mine, the coal may, from insufficient cooling, take fire again, and become as bad or worse than before. Whether this will be so remains to be seen.

A better method (I will not say the best) would have been that introduced by Mr. Goldsworthy Gurney, of filling the mine with carbonic acid, which was used with perfect success on several occasions. One instance which is given in Part II. of Professor W. A. Miller's "Elements of Chemistry," I extract in proof of its efficacy:—"The burning waste of Clackmannon, situate about seven miles from Stirling, had been for thirty years on fire. It occurred in a seam of nine-foot coal, and extended over an area of twenty-six acres. The fire was thus successfully extinguished:—About 8,000,000 cubic feet of gas were required to fill the mine, and a continuous stream of impure carbonic acid was kept up night and day for about three weeks. The difficulty lay not so much in putting out the fire, as in cooling down the ignited mass so that it should not again burst into flame on readmitting air. In order to effect the necessary reduction of the temperature, water was blown in along with the carbonic acid, in the form of a fine spray or mist. Subsequently, cold air, mixed with the spray, was blown in, and in a month from the commencement of operations the fire was found to be completely extinguished."

I do not give here the details of the process, as it would be too great an encroachment on your valuable space, but beg to refer all requiring further information to the work from which the above is extracted.

I am, &c. W. H. Wood.

Halifax, January 29.

Testing the Value of Glue.

To the Editor of the Chemical News.

Sir,—In answer to an inquiry, I lately drew your attention to Dr. Weidenbusch's paper on "The Determination of the Value of Glue," and I am induced to send you to-day as compressed an abstract as possible of his paper—the more so, as he found the quantity of gelatine present no criterion of the tenacity of the glue, which latter process is recommended by a correspondent in your number for January 11.

The author found as the result of many experiments no chemical determination to answer; he found it impossible so completely to precipitate a solution of glue by tannin as to deprive the evaporated filtrate of the characteristic smell of glue; and, even if this were possible, the amount of substance precipitated by tannin is no indicator of the comparative tenacity of the glue, in which consists of course its value. Whatever chemical means may be employed hereafter in testing glue, they will always require a verification by physical means, which the author accomplishes in the following manner:—

He casts the very finest plaster of Paris into sticks of mathematically exact dimensions in a mould of French chalk, which combines the smoothness of metal with the absorbent power of clay. Into a piece of French chalk about 1¾ inches high, a number of conical channels are drilled, about ¼ inch apart and ¼ inch in diameter at one end, and ⅛ inch at the other; these channels must be polished very smooth, and must be of exactly the same dimensions, the success depending upon the uniform size of the sticks. The mould is placed with the narrow aperture of the channels downward upon a piece of caoutchouc and a little wooden block. The gypsum is weighed out, 18 grains for each stick, well mixed with an equal weight of water, and poured into the mould. In order to prevent any air bubbles being retained, a fine wire is pushed up and down the channels, the casts are then left to stand for a couple of hours, the mould is warmed, and after 3 or 4 hours the solidified sticks are knocked out by a stout wire; they are smooth as if polished. A good stock is prepared, which is first dried by gentle heat, at last in a waterbath, till they do not lose any more in weight, when they are kept in stoppered bottles.

Now the principle of determining the value of glue is this:—If gypsum sticks are saturated with solutions of different glues, different weights or loads are required to break them with; and if the load required to break the gypsum alone is always the same, the difference is due to

the difference in the value of the glue. A little apparatus has been constructed to break the sticks, which, together with the mould, is sold by Mr. Desaga, of Heidelberg. It consists of a brass ring, with two deep notches, to receive the gypsum stick; the diameter of the ring is accurately divided into halves by a pin, placed at right angles; the ring is fixed to a stand by an arm and screw, and the apparatus is completed by a glass or iron beaker, suspended by three strings fastened to a hook, which is hung over the gypsum stick in the place indicated by the pin. This beaker has to receive the weight in mercury, and is closed at the bottom by the pinch cock for drawing off the mercury. During the experiment this beaker is also fastened to three other strings, to catch it as soon as the gypsum stick is broken by the load. These little sticks being conical, it is important to load them always at the same place, which is determined by a little measure, consisting of a glass tube, one half in length of the sticks, closed at one end and well ground at the other; the stick being placed inside the tube, a lead-pencil easily marks the exact place.

The breaking value of the sticks themselves, dried at 100° C., was first determined, the mean of many experiments being 219 grammes, the greatest part of which is made up by the weight of the beaker, the remainder of course being mercury.

After this the quantity of glue was determined as absorbed by the sticks. Result as follows:—

Weight of stick in grammes .	1·163	1·135	1·180
,, glue ,, .	0·620	0·600	0·600
,, mercury in c.c. .	101	97	96·4

The figures show a fluctuation in the breaking weight, but considering its being very high, these fluctuations are not very important; and as the fracture of the sticks gives sufficient explanation of any irregularity, it is as well to make several experiments with the same sample, and select the result with those sticks which show after the experiment the most homogeneous fracture.

After this plan a great many samples of glue have been tested in the following manner:—The glue, dried at 100° C., is weighed, left in water over night, and next morning dissolved in a water bath, and so much water added as to make up the proportion of 1 glue to 10 water. About 1 c.c. of neutral solution of indigo is added beforehand, which makes the coating of the gypsum distinct. Several sticks are then placed into the glue solution for one or two minutes, taken out, and put vertically upon a glass plate; after which they are completely dried in a water bath. They are then placed into the ring of the apparatus, the beaker is suspended, and mercury allowed to run in till the stick breaks.

In order to find the absolute weight of the load required to break the single glue stick, the volume of mercury in c.c. must be multiplied by the specified gravity of the metal (13·5), and to the result must be added 219, being the weight of beakers, plus mercury, required to break the gypsum stick by itself. It will be found that a weight of about two pounds is required to break the best sample of glue. The author has tried in vain to ascertain any relation between the tenacity and specific gravity of the glue either in the solid or liquid state. He is also fully aware that his method is open to objection in consequence of the difficulty in obtaining sticks of absolutely the same size, in uniformly saturating them with glue, &c.; but this process is by far more satisfactory than the precipitation of gelatine by tannin.

I am, &c. F. V.

Camden-square.

Preservation of Specimens.

To the Editor of the Chemical News.

Sir,—The preservation of specimens, chemical or mineralogical, in a museum has engaged my attention some time, and the plan that I intend to adopt is as follows:—Small zinc cubes could readily be made, if a quantity were ordered, and of a uniform size, say one or two inches cube; five of the faces could be soldered together, and the sixth upper one would be a glass plate fitting in a groove, and be so fixed by soluble glass and kept from any atmospheric change. The label and substance itself could be seen through this. Access to the specimens for analysis is easily allowed by moistening the compound fixing the glass. The inner surfaces of some of the cubes could be lined with the same soluble glass, to protect the zinc from chemical change, if such were likely to occur. Deliquescent salts could be compared with more stable ones—as the cupric sulphate, nitrate and chloride—by simply exhausting the air to some extent before fixing the glass plate. The whole would fit accurately into a shallow drawer of any convenient size. I think the plan will be feasible, and the interest will well repay the trouble.

I am, &c. Preserver.

University College, London, January 21.

Standard Thermometers.

To the Editor of the Chemical News.

Sir,—From a communication sent by Mr. H. C. Kay to the *Times*, it is stated that thermometers issued from one of the first houses in London, having Mr. Glaisher's certificate, differ materially from those certified at Kew. He writes:—

"Two years ago, requiring a first-class *maximum* registering thermometer for scientific purposes, I applied to Messrs. Negretti and Zambra, the eminent makers, for a standard instrument with the Kew certificate. Not having one of these at the time, they sent me (with my full approbation) one with Mr. Glaisher's certificate, No. 7381. The certificate stated that the reading was 0·5 deg. too high throughout the range. A few months ago, suspecting a more considerable difference than half a degree between this and several neighbouring instruments certified at Kew, I made a careful comparison, with the following result:—

Kew Instrument. Degrees.	Glaisher's Instrument. Degrees.
57⅓	59
70¼	72
79	81½"

When two such authorities as these disagree, it is difficult to know upon whom to rely. But surely there can be no difficulty in sending out any number of thermometers of an accuracy within 0·2 degree without any increase on the price. The process of making and graduating thermometers is so simple, and the ease with which they can be compared with a standard instrument so great, that makers ought to be expected as a matter of course to supply all their instruments, whether "certified," "guaranteed," or otherwise, accurate, within a limit of at least a quarter of a degree. By laying such stress on the difference between instruments "certified at Kew," and uncertified ones, manufacturers lead the public to believe that the accurate graduation of a thermometer is a matter of some difficulty, whereas it is really one of the simplest and easiest things in the world, to those who possess the proper appliances, and not very difficult even for an amateur. I am sure some of our noted thermometer makers will corroborate me in the above remarks.

I am, &c. Zero.

MISCELLANEOUS.

Photographs on Season Tickets at the International Exhibition.—In the programme of arrangements for the issue of tickets to the forthcoming International Exhibition, it is intended to render photography available as a means of identification of the owners of season tickets, which will not be transferable.

The price of the tickets for gentlemen will be 100 fr., those of ladies 60 fr. The signature of the ticket-holder must be given whenever it is demanded, but this condition is qualified by the following clause:—"However, the ticket-owners shall be exempted from the verification by means of signature, by giving or sending two copies of their photographed likeness, one of which will be affixed to the ticket." Weekly tickets at 6 fr. will be issued, but, according to the programme, only to persons who may present themselves at the office with their photographs. The ticket will be affixed to those photographs. Exhibitors will receive season tickets subject to the same conditions.—*The Photographic News.*

Labels for Reagent Bottles.—Messrs. Jackson and Townson, Bishopsgate Street Within, have published a very convenient sheet of reagent tables, according to the new notation and nomenclature. It is not every one who will recognise familiar tests under the names "Hydrammonic carbonate, $(NH_4)HCO_3$," "Hydric chloride, HCl," "Hydric-hydro fluo-silicate, H_2SiF_6," &c., but their difficulties will soon vanish when these labels are constantly before them. Teachers and students cannot adopt a better means of familiarising themselves with modern nomenclature than by using these labels in their laboratories. They are printed in large bold type, and are well gummed at the back.

The Thermoterion, or economic heat retainer, is the name given to a piece of apparatus which will be found exceedingly useful in laboratories. It consists of a series of concentric metallic or other vessels, the inner one containing a readily removable glass beaker; outside this is a space for hot water, which is supplied through a covered opening, and it is the heat from this water which keeps anything warm which may be placed in the glass beaker. Outside the hot water space is an air-jacket which insulates the hot water and obstructs the radiation of its heat. Air, being a non-conductor of heat, enables a high temperature to be maintained within the apparatus for many hours. As an experiment, boiling water was poured into the beaker and hot water space, and the temperature of liquid in the beaker was taken every hour. At the end of the first hour it was 186° F.; second hour, 171°; third, 159°; fourth, 149°; fifth, 141°; sixth, 133°; seventh, 126°; eighth, 119°; ninth, 113°; tenth, 108°. Chemists engaged in research, or wishing to prepare good crystals of any compound by very slow cooling, will appreciate the advantage of an apparatus of this character, which enables the crystallising operation to be prolonged for so many hours. It will be equally convenient when digestions, solutions, or pressure-tube operations are required to be conducted, and where an actual boiling temperature is not needed.

A Chemical Theory of Cell Formation.—Dr. C. Montgomery has written a very remarkable paper, read before the Royal Society, December 20, 1866, on the above subject. The whole paper has a very particular interest, and his facts are well worth verifying by all who have an opportunity of doing so. From preliminary observations rationally treated, the above gentleman made the following experiments:—A viscid substance was required, and myeline, after a long search, was found to be the one. When to myeline in its *dry amorphous* state water was added, slender tubes were seen to shoot forth from all free margins, "being sometimes wonderfully like nerve *tubes* in appearance, flexible and plastic." From this crystallisation was inferred, and this extension was prevented by an intimate admixture with the white of an egg; clear globules resulted from imbibition by a viscid substance. By further extensions of this observation and similar ones, globules with lively molecular movement were found. A typical cell with nucleus, and even nucleolus, and "the white margin so often mistaken for a cell wall, was always present." This latter fact will be a decisive answer to Mohl's theories. Mother cells were formed. Lastly, globules were obtained with another enclosed smaller globule, and this was sometimes multiple, like the typical pus cell. If, instead of water, serum be added to the thinly-spread myeline, bi-concave discs will form, only generally much larger than blood-corpuscles. The changes in theory effected by these precise facts will, of course, be very great. The author observes that "'cells" being thus merely the physical result of chemical changes, they can no longer afford a last retreat to those specific forces called vital. Physiology must aim at being something more than the study of the functions of a variety of ultimate organic units."

Meetings for the Week.

Monday, February 4.

Royal Institution, 2 p.m. General Monthly Meeting.

Tuesday, February 5.

Royal Institution, 3 p.m. Professor Tyndall, "*On Vibratory Motion, with special reference to Sound.*"

Pathological Society, 8 p.m.

Ethnological Society, 8 p.m.

Anthropological Society, 8 p.m.

Wednesday, February 6.

Society of Arts, 8 p.m.

Thursday, February 7.

Royal Institution, 3 p.m. Professor Tyndall, "*On Vibratory Motion, with special reference to Sound.*"

Royal Society, 8½ p.m.

Chemical Society, 8 p.m.

Friday, February 8.

Royal Institution, at 8 p.m. Rev. F. W. Farrar, "*On Public School Education.*"

Astronomical Society, 3 p.m. Anniversary.

Saturday, February 9.

Royal Institution, at 3 p.m. G. A. Macfarren, Esq., "*On Harmony.*"

ANSWERS TO CORRESPONDENTS.

G. Lunge.—Received with thanks.

Metallurgist.—Dr. Percy's "Metallurgy," first volume, contains all the information you can desire on the manufacture of spelter.

Constant Reader.—The statements are certainly open to criticism, and will probably receive it.

F. Samuels.—We must decline to give the address required.

L. N.—Fine white blotting-paper will answer most of the purposes of a laboratory better than Swedish filtering-paper. The latter is very slow in its action.

C. N. will find the address of the manufacturer of the "New Filtering Apparatus" in our advertisement pages.

Books Received.—Lessons in Elementary Chemistry, Inorganic and Organic, by H. E. Roscoe, B.A., F.R.S.

W. A., Mass.—Dr. Hofmann's Report on Class II., Sect. A., Exhibition 1862, is out of print.

Distiller.—Böttger's test for copper in brandy is very good. Agitate a little of the suspected brandy with a few drops of pure olive-oil. If copper be present, the oil will acquire a green colour.

M. P. T.—The new edition of the Pharmacopœia will be out in a week or two.

Uses of Naphthaline.—*T. A. R.* writes as follows:—"I find a very considerable quantity of naphthaline in distilling my tar, and am too distant from any likely market where it might be sold. Could any of your numerous correspondents suggest any use for it? Such information I would not object to pay for. If there are any uses, although but in a moderate way, the knowledge of them would be of value to those, like myself, in a remote corner."

E. K.—For an explanation of the term "triatomic," as applied to glycerine, see Wurtz's "Introduction to Chemical Philosophy," page 151. To answer your questions fully, it would be necessary to give an abstract of the book.

T. J. Y.—The best cement for attaching jewels to metal or to each other is made by dissolving a quarter of an ounce of gum mastic in two ounces of alcohol; then soak half an ounce of isinglass in four ounces of water for twenty-four hours, evaporate in a water bath till it is reduced to two ounces, add two ounces of alcohol, and strain through linen. Then mix, whilst still warm, with the solution of gum mastic. Add one drachm of powdered gum ammoniac, and triturate in a mortar till perfectly incorporated. This is sometimes called Armenian cement. It resists moisture and dries colourless. It will unite glass, china, and even polished steel. When required for use, it must be softened by placing the bottle in hot water.

Received.—R. J. T.; S. Muspratt, M.D.; A Subscriber.

LONDON WATER: PAST, PRESENT, FUTURE.

FUTURE.

We have tried to show that the questions of sewerage and water supply always require a discussion in common, from the present intimate relations of the two systems. The impurities from the one may influence the other, either locally or from a common centre, or by necessity from forces known to be at work. By the second means, many have tried to show, on the ground of infiltration of the soil by sewage, that great evils may be brought about, as implied by the Registrar-General in his last quarterly report:—"3691 deaths by cholera and 740 by diarrhœa—that is, 4431 together—occurred in the East London districts, among 607,945 people supplied with water chiefly from the Old Ford reservoir of one company." The comment of Dr. Frankland on this reservoir is:—"It, as I was informed, is excavated in clay, but the side next to the navigation branch of the foul River Lea is of gravel. Nevertheless, the position of this reservoir with its two and a half acres of floor, sixteen feet below the surface of a badly-drained district, is fraught with much peril during the prevalence of epidemic disease." Dr. Hawksley* forcibly shows the evils that have their origin from the third cause:—"We fling into this immense system of tubes every day in London 4224 tons of human organic matter, spread over acres and acres of surface, kept continually moist by the water poured through, and constantly aerated by a current of air rushing from the periphery of the system to the centre; wherever there is an opening, be it gully-hole, or drain-pipe, or water-closet, there must ever be issuing pestiferous gases." We may add, not gases only, but also that by vapours particles are carried mechanically, like dust by a gale of wind. The same author, in his treatise on "Matter," observes also:—"The larger the sewers, the greater the surface for refuse matter—the greater the volume of air with a current, in a tube from the lower to the higher level, from the colder to the warmer atmosphere." Dr. Sanderson's manometer demonstrates the constant upward pressure of the gases within the sewers; and it is obvious that for every inch of barometric pressure diminished, one-thirtieth of the whole volume of foul air in the sewers must ascend into the town. No wonder that we can foretell rain by the odours from the drains and gully-holes." Thus, then, with three classes of pollution existing, is it rational to bring water by 183 miles of aqueducts from the Severn at the cost of 8,600,000*l.*, or from Westmoreland, a distance of 240 miles, for 9,650,000*l.*, if it is to be supplied as at present? The schemes are truly magnificent; but, leaving out the question of the cost, would it be wise for 3,000,000 people to depend on water the source of which is 200 miles away, with all the chances of the supply being cut off taken into consideration? Dr. Hawksley says, if you will only renounce the water-closet system for the disposal of sewage, and use earth pans, you may secure the following advantages:—You may keep your present supply of water—which, if only left alone, is not so bad after all—use the sewers as waste water pipes only; breathe a purer air; return to the agriculturist the materials that by neglect of such return cause the comparative barrenness of our fields—not at the cost of 8,000,000*l.*, but making a handsome profit by such economy of material. Every one who can appreciate a philosophical and well-arranged scheme, carried into the smallest detail, should read Dr. Hawksley's book.

If the sewage is once disposed of in a rational manner, we may then, and not till then, set about securing the best water close at hand. Mr. Telford Macneill† is a good authority to follow here, but we have not space to follow him far now; but among the questions proposed are: If 200,000,000 gallons are required now, how much will be required in ten years' time, before which the most sanguine could not expect the large plans to be made available, and should not any scheme at a moderate view set this question at rest for twenty years more? The population of London, with the suburbs, at the present rate of increase, will then have reached nearly 6,000,000, requiring 400,000,000 gallons daily. Again, the author reminds us that, when the supply was improved from 1850 to 1856, the daily consumption was doubled. "Must London, then, look to both sources for its future demand? My answer is that the Thames, by the means and combinations to be described, will give an almost unlimited quantity, and of pure quality, without injury to the river or annoyance to its inhabitants." The Bagshot Sands are then proposed as a natural filtering ground for the water of the area of the basin drained by the Thames above Teddington Lock of 2,500,000 acres, with a rainfall of twenty-five inches per annum, the introduction of sewage being provided against by a very feasible scheme. The plan will be effectual without any attempt to alter the present condition of the Thames. The supply so obtained during droughts would be 800,000,000 gallons daily, close at hand. Quantity is so far satisfactorily accounted for.

As regards quality the scheme is most promising; the mean of the river and spring water will be eight and a half degrees of hardness, and two degrees of this will be lost in the passage, with a fall to prevent organic life (we would suggest the more abrupt the better for oxidation and arrest of development), and lastly, and most important of all, by percolation through an extended area, uniformity of temperature will result. For details we refer our readers to Mr. Macneill's paper. It will be seen that by this scheme we are brought to the plan so approved by the commissioners in 1851, and rejected on account of defect in quantity, the Farnham area being included in that of the proposed scheme; but the Watford basin, we must add, was preferred by them.

In reviewing thus the whole matter, we would depre-

* "Matter and Earth," by Thomas Hawksley, M.B. Lond., M.R.C.P. London: John Churchill and Sons, New Burlington Street. 1867.

† "Water Supply of London, by means of Natural Filtration of the Waters of the River Thames," by Telford Macneill. London: Edward Stanford, 6, Charing Cross, S.W. 1866.

cate the adoption of any scheme that possesses mainly a feature of novelty, or an opportunity for extensive engineering works, and would urge upon the commission about to discuss the question the lessons taught by a long experience, and the clear principles laid down by commissioners not less able than themselves.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Freezing of Aerated Waters, by Charles Tomlinson, *F.C.S.*

Priestley was, I think, the first who impregnated water with carbonic acid, so as to resemble Pyrmont or Selzer water, and he recommended brewers and distillers to employ the gas of their fermenting tuns in the manufacture of such water. This was about the year 1767. When he found that fixed air could be liberated from chalk or marble by the action of oil of vitriol, he contrived a simple but effective apparatus for impregnating water with its own bulk of the gas, and he even recommended the use of a condensing engine for impregnating the water more highly. Priestley must therefore be considered as the inventor of soda water. He attempted to impregnate ice with carbonic acid, but failed to do so. He then exposed a quantity of the impregnated water to the action of a freezing mixture. "This mixture instantly freezing the water that was contiguous to the sides of the glass, the air was discharged plentifully, so that I catched a considerable quantity in a bladder tied to the mouth of the phial." Another portion of the liquid was frozen, and "was almost as much like snow as ice, such a quantity of air-bubbles were contained in it, by which it was prodigiously increased in bulk." He further remarked that impregnated water frozen by natural cold and then thawed, had "the taste of common water only."*

During the recent cold weather I impregnated with carbonic acid distilled water contained in eight-ounce and other phials, which were then corked and exposed to the air at temperatures ranging between 23° and 30° F. The first action of the cold was to produce long needles of clear transparent ice, as thick as the little finger, occupying about the centre of the bottle, in some cases parallel with the sides, in others at an angle thereto. The further action of the cold was to enclose these transparent crystals in opaque ice, to thrust out the cork and break the bottle. In one case the bottom of the bottle was forced out; in others the sides were cracked, and the cracks ran in lines from top to bottom, nearly parallel with the long axis of the bottle. Opaque ice filled the neck, and even overflowed, so that the ejection of the cork, the fracture of the bottle, and the overflow of the ice, were simultaneous acts.

On mentioning these results to my friend Professor Miller, he advised me to try the effects of a low temperature on a bottle of soda water. Accordingly, two bottles of soda water, A and B, were taken. A was put into a jug containing a freezing mixture of snow and salt. In the course of a few minutes the soda water froze into a perfectly opaque dead-white mass. B was suspended just outside my laboratory window in an atmosphere at 28°. In the course of three-quarters of an hour long straight crystals of transparent ice passed from just below the neck to near the bottom of the bottle. In the course of another hour amorphous opaque ice began to form in the neck, and during the night this extended downwards, completely enclosing the transparent crystals (doubtless of pure water), so that the bottle, in the morning, was not to be distinguished in appearance from A.

Both bottles were now brought into the room, which was at 37°. In both a ring of ice had formed round the cork from the escape of some of the liquid from within. In both there was a feeble escape of gas, which soon increased so as to form an audible hiss. In both the corks were strained and distorted, and in A the cork had burst the wire, so that it was held apparently by the string only. On cutting the string it was found that the cork was frozen to the ice in the bottle. The ice had in both bottles slowly and quietly lifted up the cork a little, and compressed it so as to allow escape to some liquid and a constant escape to the gas—in fact, the expansion of the liquid in freezing, instead of bursting the bottle, found a line of least resistance by compressing the cork.

On watching the process of thawing, the opaque ice impregnated with gas was the first to liquefy, but the transparent crystals had become so penetrated by the opaque ice that they could not be made out during the thawing.

At the shop where I got the soda water most of the stock was frozen. I found that where transparent crystals only were formed, these could be soon thawed, and the soda water was not much, if at all, injured; but in all cases where opaque ice had formed the cork had been raised, and there was an escape of gas. On exposing the soda water a second time to the air at 26°, it froze into a vitreous mass of transparent ice; and yet there was a good deal of gas left in the water, for on testing it with lime water the precipitate was immediately taken up, and the solution became clear.

It may be worthy of remark that corked bottles of water impregnated with carbonic acid may be left on the ground during many hours exposed to a temperature of 24° without freezing. In one such case the bottle was shaken violently, but the water remained liquid. On removing the cork, however, fan-shaped crystals of opaque ice diverged from the surface of the water, and these were met by other radiating masses of crystals, so that in a few seconds the water became converted into nearly opaque ice; the bottle was not broken. A small phial of impregnated water was frozen at 24° into opaque ice without being broken or having the cork removed.

As nitrous oxide is more soluble in cold water than carbonic acid, I impregnated with that gas distilled water contained in two eight-ounce phials A B, and also in an open beaker C, of the capacity of about a pint. All three vessels were placed on the ground at the temperature of 26°. After an hour's exposure there was no appearance of freezing. In another fifteen minutes the surface of C was covered with scanty lines of transparent ice. A also contained a few long, thin, serrated crystals of transparent ice, extending the whole length of the phial. There was also a delicate icy foliage on the inner surface of the phial, following the slight projecting lines formed on the surface in the process of manufacture; the ice behaving as camphor vapour does when a bottle containing a lump of camphor is left on the window pane. The water in B was quite unfrozen; agitation and the removal of the cork had no effect. In the course of another hour the beaker displayed icy foliage on the inner surface, and

* "Experiments on Air." 1790. Vol. i. p. 120.

short crystals like grass shot up from the bottom. There was little or no change in A and B during two hours more. The vessels were left at 11 p.m., and next morning (the thermometer marked 24°) A and B were frozen and broken; C was also frozen, but not broken. In all these cases there was this difference as compared with the carbonic acid water. The centre remained unfrozen, so that on inverting the bottles a large bubble of gas ascended through a column of liquid. In the case of the beaker the central fluid portion was spherical, and from the surface of the sphere proceeded radially, large pyriform bubbles of gas, with the bulbs all directed to the centre. On showing this to Mr. Wetherell, the well known palæontologist, he pointed out the striking resemblance of this figure to some of the sea anemones. There was a layer of opaque ice above this figure, and the surface was bounded by a layer of transparent ice. The central liquid portion appeared to be a strong solution of the gas, for on taking the vessels into a warm room bubbles were liberated from it.

Highgate, January 28.

On the Analysis of Apatite—$3(3\,CaOPO_5) + CaCl$, or $(CaFl)$, *by* F. Wöhler, *Professor of Chemistry in the University of Göttingen.*

To estimate the chlorine, dissolve a known weight of the mineral, not pulverised, in dilute nitric acid,* and precipitate the chlorine with nitrate of silver.

Some kinds of apatite contain a small quantity of fluorine. When it is desired to ascertain the presence of this body, finely powder the mineral, and then mix it in a platinum crucible with concentrated sulphuric acid, covered over with a piece of glass, coated with wax and having characters traced on it with the point of a needle. Then heat the crucible, taking care not to melt the wax. If fluorine is present, the characters will be found engraved on the glass when the wax is removed. The amount of fluorine present may be deduced from the loss of weight obtained in the complete analysis. (This will be further explained in the analysis of silicates.)

The lime and phosphoric acid may be determined as in bone ash, or the following method may be employed:—Dissolve the mineral in nitric acid in a capsule, and then add pure mercury in such a quantity that when the acid is saturated with it there still remains a portion of mercury undissolved.

Evaporate the mixture on the water-bath to complete dryness. If a slight odour of nitric acid is still disengaged, add more water, and evaporate again to dryness, so as to get rid of it completely; then extract with water, place it on the smallest possible filter, and well wash the residue, which contains all the phosphoric acid.

Besides the excess of mercury the filtrate contains all the lime. With hydrochloric acid precipitate the protosalt of mercury. As a little binoxide of mercury may have been formed, precipitate the solution with ammonia. If the mineral contains iron or other bases precipitable with ammonia, these remain after calcining the last precipitate. The solution is rapidly filtered with as little exposure to the air as possible, and the lime in it precipitated with oxalate of ammonia.

The filter, which besides the excess of mercury contains phosphoric acid, is well dried, and the whole is placed in a platinum crucible and mixed with carbonate of potash and soda. The crucible is then heated to a temperature below redness, under a chimney with a good draught, until all the mercury is volatilised, after which it may be heated to redness and the contents fused. Then dissolve in water, add an excess of hydrochloric acid, and precipitate the phosphoric acid with ammonia and sulphate of magnesia.

* Certain brown apatites leave as a residue a small quantity of a crystalline powder which is cryptolite (phosphate of protoxide of cerium).

On a New Maroon Pigment, by William Skey, *Analyst to the Geological Survey, New Zealand.*

The blood-red compound obtained by adding a soluble sulphocyanide to a salt of iron in solution can be made (apparently at least) to combine with resin in the following manner:—

To concentrated solution of sesquichloride of iron and sulphocyanide of potassium in ether an etherial solution of common resin is added and well shaken together, then mixed with a sufficiency of water to cause a precipitate, when it will be found, after the mixture has stood a few hours, that the whole, or nearly the whole, of the red-coloured iron compound has united with the precipitated resin, forming the maroon-coloured pigment in question.

When this coloured substance is finely powdered and mixed with water, the water is not the least coloured; from whence I infer the red-coloured iron compound afforded by the mixture of the sulphocyanide of potassium with the iron salt has chemically united itself with the resin.

TECHNICAL CHEMISTRY.

On a New Process of Organic Elementary Analysis for Substances containing Chlorine, by C. M. Warren.

Organic bodies containing chlorine—and probably those also that contain bromine and iodine—may be analysed by a process analogous to that which I have already described for substances containing sulphur.*

As in that process, so also in this, the substance is burnt in a stream of oxygen gas, in the manner described in my first paper, "*On Organic Elementary Analysis.*"†

Similarly, also, as in the analysis of sulphur compounds, the chlorine is absorbed and retained during the combustion, by a suitable substance placed in the anterior end of the combustion tube; this substance being subsequently removed, and the chlorine determined therefrom in the usual manner. The carbon and hydrogen, in either process, are determined from the same portion of the substance as the sulphur or chlorine, in a manner similar in other respects to that described for simple hydrocarbons.‡

In pursuing this research some difficulty was experienced, as was anticipated, in finding a substance which would absorb and retain the whole of the chlorine, under conditions that would at the same time insure that every trace of the carbonic acid and water should pass through unabsorbed.

The search for this substance was confined to the oxides of the heavy metals, as these alone, from their strong affinity for chlorine and weak affinity for carbonic acid, seemed to give encouragement of success.

The difficulty, however, in finding such a substance

* *Proceedings of the American Academy*, March, 1865; *American Journal of Science and Arts*, 1866, xli. 40.

† *Proceedings of the American Academy*, 1864, p. 251; *American Journal of Science and Arts*, 1864, xxxviii. 387.

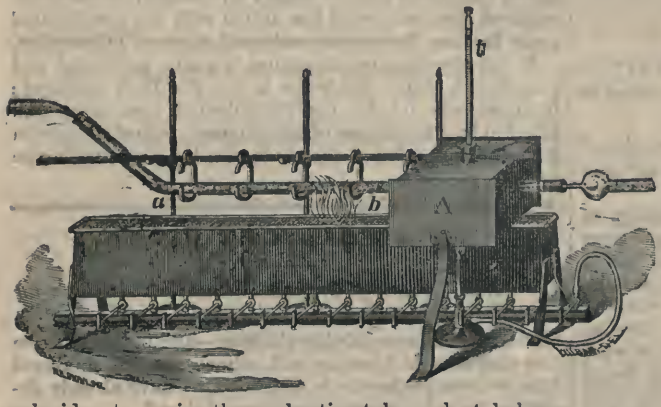
‡ *Loc. cit.*

was chiefly due to the circumstance that most of the chlorides of these metals are either too volatile, or begin to suffer decomposition at too low a temperature; it being requisite that the absorbing substance, and the newly formed chloride of the same, should bear to be heated sufficiently to prevent both condensation of water and absorption of carbonic acid, and at the same time avoid a temperature high enough to occasion any appreciable decomposition of the chloride.

This question of temperature became, therefore, a prominent one in the investigation, as evidently the success of the process must depend, in a great degree, on the proper management of the temperature of the absorbing substance, within such limits as might be found to give satisfactory results. Hence, my first step was to devise means to secure the necessary control of the temperature of that part of the combustion tube which should contain this substance.

For this purpose was constructed a sheet-iron air-bath or chamber, A, Fig. 1, provided with two holes—one in

Fig. 1.



each side—to receive the combustion tube, and a tubulure in the top for a thermometer. One end of the air-bath is made to rest on the combustion furnace, and the other, which projects a few inches from the front of the furnace to make room for a lamp, is supported by a leg resting upon the table. The bulb of the thermometer is placed in a central position, in the interior of the bath, close by the side of the combustion tube.

The temperature of the air-bath, and consequently of the substance contained in the combustion tube within, is easily regulated by means of a Bunsen's burner placed under the front end of the bath, as shown in Fig. 1. With the exception of the air-bath, the apparatus employed is the same as that used in the analysis of substances containing sulphur, a full description of which is given in the papers above referred to.

The substance that I have found best adapted to absorb the chlorine, for substances easily combustible, is brown oxide of copper, prepared by precipitation with potassa, and ignition over a gas flame.

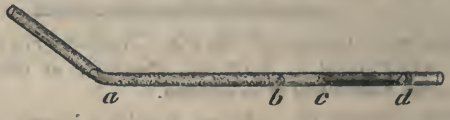
Difficultly combustible substances, like chloroform, are not completely burnt in oxygen in contact with asbestos alone, but require the presence of a body having an affinity for chlorine; otherwise there is formed a liquid body, difficultly volatile, probably a chloride of carbon, which condenses in the vacant part of the tube, from *b* to *c*, Fig. 2, and which cannot be entirely burnt off, and save the analysis. In such cases the absorbing substance is mixed with the asbestos occupying the back part of the tube, where the combustion takes place. It is evident that oxide of copper would not answer for this purpose, as at so high a temperature dichloride of copper would be formed, which, being insoluble in dilute acids, would interfere with the determination of the chlorine. Oxide of zinc has been found to give good results with such substances.

The preparation of the combustion tube, and the arrangement of the mixture of asbestos and the absorbing substance, is the same—except in the case last mentioned—as in the analysis of substances containing sulphur, as shown in Fig. 2—viz., the space between *a* and *b*, about ten inches in length, is packed with pure asbestos; between *b* and *c*—a space of about two inches—being left vacant, a plug of asbestos is placed at *c*; the space between *c* and *d*, four to five inches in length, is filled with an intimate mixture of asbestos and brown oxide of copper; and, finally, a plug of asbestos is placed at *d*.

After the combustion, the chloride, together with the excess of oxide, is extracted from the asbestos by means of dilute nitric acid.

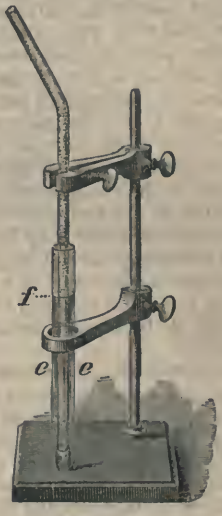
To facilitate the removal of what may adhere to the

Fig. 2.



sides of the tube, the apparatus shown in Fig. 3 will be found serviceable, as in the analysis of sulphur compounds.

Fig. 3.



(To be continued.)

What is a "Professor?"—"The term *professor* is sometimes put very prominently before us as one of superior distinction—a still larger handle to the name. We have, however, professors of hair cutting, of carpet shaking, of dancing, and of the 'noble art of self-defence,' as well as of medicine or surgery; and if we may judge of the public appreciation of the term by the use made of it in the newspapers, it has a much wider significance than that of men of learning or science appointed to the office of teachers by incorporated colleges, which is its technical definition."—*A Discourse on Titles, &c., by Edward Parrish, Philadelphia.*

PHARMACY, TOXICOLOGY, &c.

On the Preparation of Medical Tinctures, by M.* FILHOL.

THE various writers on the preparation of medical tinctures have given most of their attention to the best method of exhausting substances submitted to the action of a solvent (alcohol, ether, &c.). Two methods have been proposed. The first consists in macerating the substances properly divided for a sufficient time in the liquid which is to produce the tincture, and filtering and submitting the residue to sufficient pressure to extract the portion of tincture it retains. The second, known as the displacement method, consists in submitting the substance destined to undergo the action of a solvent to a methodical washing and displacing the tincture remaining in the powder by water, or by alcohol when an alcoholic tincture is desired.

It is generally admitted that the latter method produces in a very short time a tincture quite as rich, sometimes even richer, in soluble material than that obtained from the same substances by prolonged maceration. But it is undeniable that those prepared by maceration keep better, and are less apt to become turbid, than those prepared by the second method. On the other hand, it seems impossible to displace alcohol by water, for the two liquids mix in an appreciable manner, and little economy can result from this plan. The maceration process seems then to be the best.

I will not here enter into all that has been said for and against each of these methods, but will merely observe that the question does not appear to me to have been hitherto studied in a manner which is alone calculated to remove all doubts.

It would, in fact, be of little consequence that tinctures prepared by the displacement method should, after a few days, furnish a slight deposit, were it proved that the substance forming this deposit was inert, and that its preparation did not lessen the value of the medicine. It would be quite the reverse were this deposit formed essentially of principles possessing great activity. This, then, is a point which it was necessary should be cleared up by a series of consistent researches and qualitative analysis, executed with all possible care and precision.

It is important, also, in estimating the value of the tinctures, not to rely solely on their relative densities, or on the quantity of dry residue left by evaporation, but rather on the results of the analyses of these residues, for it sometimes happens that the best tincture gives the least residue, being richer in alkaloids and other really active principles than those giving the smaller quantity of residue. I am aware that the researches I have indicated would require much time and skill on the part of the operator, but there are many druggists capable of successfully undertaking them.

One word more concerning tinctures.

In my opinion, alcohol is not so good a preservative as it is generally supposed to be, and the tinctures should be used as soon as possible after they are prepared. The following facts prove that certain immediate principles of vegetable origin alter when dissolved in alcohol.

A tincture prepared from the leaves of a plant will be of a beautiful green colour, due to the presence of chlorophyl, and will, under the influence of hydrochloric acid, undergo transformations, which M. Frémy has described, and which I have studied myself. Now, these transformations do not take place in a tincture which has been prepared for several months, and the most essential characteristics of chlorophyl disappear.

The petals of the ranunculus, macerated in alcohol, give a golden yellow tincture, which, on the addition of an equal volume of hydrochloric acid, turns green. After the liquid has been filtered, a yellow substance remains on the paper, and the filtered liquid is of a pure blue colour. Nothing of this kind takes place when the tincture has been kept some time. Then the liquid remains yellow in spite of the addition of hydrochloric acid. In this case the xanthine of the flowers has been altered, as well as the chlorophyl.

Attentive study will probably lead to the discovery that other matters also undergo great alteration.

Now it is certain that tinctures, possessing all the properties I have mentioned, can be prepared from leaves or flowers well dried and kept from air and light during several months. It is therefore better to preserve the plants than the tinctures, and the latter should, as I have said, be prepared in small quantities, and used as fresh as possible.

* *Journal de Pharmacie et de Chimie*, vol. iv. p. 22.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, February 5, 1867.

THE Council of the French Photographic Society, whose establishment is at 9, Rue Cadet, has taken the following resolution, and thus shows a very good example, which will be, we hope, imitated. All the French and foreign strangers admitted to the Exhibition will have admittance to the saloons of the Society and will be able to attend the meetings. A personal card will be delivered to them at the Secretary's office of the Society. Besides the usual meeting held the first Friday in each month, the Society will meet on the third Friday either for a general meeting or to hear a lecture on subjects interesting to photography. The ordinary recess of the Society, which habitually takes place in the month of August, will be this year postponed to the months of October and November.

At the demand of M. Regnault, the illustrious chemist and physicist, president of the Photographic Society, the Parisian Gas Company has decided to manufacture on a large scale alkaline sulphocyanides, and especially the sulphocyanide of sodium. The price fixed by the Company is 3 frs. the kilogramme. Thanks to this decision, the introduction of sulphocyanides into photographic consumption is henceforth assured, for the Company can produce 60 tons of them annually.

Heliographic engraving, or the production by means of photography of proofs which can be printed from, either by copper-plate or lithographic impression, by a thick ink or by carbon, has made this year in France and England a really wonderful progress. On Friday, the 2nd inst., M. Baldus presented to the Photographic Society three long series of proofs, taken from ancient engravings or from nature, which excited universal admiration. In fact, nothing could be seen more beautiful than the reproduction by this process of the celebrated engravings by Mark Anthony, after Raphael. M. Baldus did not explain his process, for this principal reason, that it is so simple that one would scarcely believe it. Moreover, it is a process perfectly industrial, and of which the products can be given at a fabulously low price. For us who are acquainted with the phototypes in carbon or thick inks of Messrs. Woodbury, Swan, &c., we do not hesitate to declare that M. Baldus leaves them very far behind him. We can compare his proofs only to the heliographic engraving of M. Garnier.

MM. Camille Saint-Pierre and Pugo, Professors of the Faculty of Montpellier, with regard to the question of taking the density of wines, have made some very conscientious researches upon the densities of the wines of the Department of L'Herault, of which the following are the results. They are interesting, to a certain point, to England, to which country a great deal of wine is exported from Cette. The density of the red wines of L'Herault differs but little from that of water; the weight of 1000 litres of wine varies from 994 to 999 kilogrammes. The dry white wines are generally a little lighter than the red wines; 1000 litres weigh from 991 to 994 kilogrammes. As to sweet wines, which comprise muscatel and liqueur wines, notwithstanding the quantity of alcohol they contain, which tends to lower their density, they have a specific gravity greater than that of water, owing to the great quantity of sugar they contain. Vinegars are heavier than the wines from which they are obtained. To sell, then, white and red wines by weight does not expose one to a sensible error in commercial transactions. With regard to sweet wines, there is generally sufficient difference between their densities and that of water; so that, in the substitution of the sale by weight instead of by measure, the relation of the weight to the volume should be taken into account. The measuring of wine is a very costly process; it takes up much time, and is at the same time very inexact. There will be great advantages in abandoning it and adopting the sale by weight.

M. Stephan, Director of the Observatory at Marseilles—a supplementary one to the Imperial Observatory of Paris—discovered in the night of Tuesday, January 22, a new comet, of which he could only determine the position on the 25th.

Mean time at Marseilles, January 25 . 8h. 53m. 35s.
Right ascension of the comet . . 2h. 33m. 53·58.
North Polar distance . . . . 74° 26′.
Hourly movement: in right ascension +5′17s.; in Polar distance −1·29′.

The comet is rather brilliant, in appearance generally round, with a well-defined nucleus; it appears denser at one side than the other, so as to lead to the supposition that the tail is fan-shaped. The apparition of a comet after the excellent researches of Messrs. Huggins and Miller on spectral analysis, is a fortunate event that must be at once announced, so as not to lose any chance of observation; and we find it very extraordinary that M. Le Verrier did not give any particulars of the new comet before the bulletin of the Observatory, dated February 1. No. 1625 of the *Astronomische Nachrichten*, published on January 30, does not say a word about the comet.

The "Florentin" diamond—such is the name given to a jewel in the possession of the Imperial Treasury at Vienna. It is of the first water, and is mentioned in all the books on precious stones as weighing 139¼ carats, or 2¾ carats more than the "Regent," worn by the Empress of the French, and 54½ carats less than the "Orlof" of the Russian regalia. The inventory of the Imperial Treasury of Austria gives its weight as 133½ carats. A commission convoked for this purpose has recently ascertained, by means of an extremely delicate balance, that this diamond weighs 27·454 grammes = 133·185 carats of Vienna = 133·600 carats of Paris = 139·20 carats of Florence, and that at a temperature of 19° C. its density was to that of water in the ratio of 3·5213 to 1·000. Dr. Hörnes, director of the Imperial Museum of Mineralogy, and member of the above-named commission, has taken a plaster cast of the "Florentin," so as to serve as a model for a copy in crystal glass, representing exactly the bulk, shape, and tint* of the original. The value of this diamond, according to the usual commercial rules of calculation, amounts to two and a half millions of florins, or about 250,000*l*.

* Our Vienna correspondent has not given the colour of this celebrated diamond.—F. M.

MM. J. Vavin and G. Fribourg have invented an automatic electro-chemical method of electric transmission of despatches, with a view of utilising all the velocity of the current on telegraphic lines. It consists in the distribution of the current through as many small wires very short and isolated as there are signals to be transmitted, all the while only employing one wire on the main line. Each of these small isolated wires communicates on the one hand with a metallic plate of a particular form fixed in gutta-percha, and on the other hand with a metallic division of a disc, which is equally formed of an insulating substance. A group of eleven of these small laminæ form a sort of character which will give all the letters of the alphabet by the suppression of certain portions of the fundamental form. Now, suppose rows of these compound characters to be placed on a sheet of prepared paper of a metallic nature, the words of the telegram to be sent are written on them with isolating ink, leaving the other parts of the small "stereotyped" blocks untouched. The consequence is that the current is intercepted at every point touched by the ink, and a letter is imprinted on the prepared paper at the other end of the line where the telegram is to be received. It is hard to explain the system without an illustration; yet, if the invention meets the encouragement it deserves and works well, we shall return to the subject and give an illustration.

M. E. Arnoux, chef d'escadron of the French Marine Artillery, has proposed a new arrangement in the telegraphic service, the aim of which is to popularise and extend the use of the telegraph. For this purpose he deems it necessary to—

1. Guarantee the secresy of the despatches in the same way as of letters by post.
2. To lower the rate of telegraphic messages, so as to place them on a rational and equitable footing.
3. Lastly, to increase considerably the number of transmissions, at the same time augmenting as little as possible the number of assistants and the apparatus in use.

The author (and perhaps justly) exclaims against routine, and wishes for reform. He says:—"*Non seulement la routine conserve scrupuleusement comme un dépôt sacré les vieilles erreurs, mais elle s'oppose encore de toutes ses forces aux améliorations les plus legitimes,*" &c., &c.

The immense success of the lighting up of the ball *fête* of the skaters at the Bois de Boulogne caused his Majesty the Emperor of the French to make a trial again of the electric light for illuminating the courts of the Tuileries and the Carousel. On Saturday, February 2, M. Serrin was invited to place two of his lamps on the Arc de Triomphe of the Place du Carousel. The light being enclosed in two ellipsoidal enamelled urns, made by M. Paris, was not only unfatiguing to the eye, but it was contemplated with pleasure. Two electric burners are evidently too few for this immense space, and yet it was entirely lit up. In the interior of the court of the Tuileries the light was better than that of all the gaslights; on the Place du Carousel the gas was nearly all eclipsed. The continuity and fixity of the light were truly astonishing. When, according to the adopted project, the iron railing forming the present enclosure of the courtyard of the Tuileries is advanced as far as the middle of the Place, four or six lamps lit by electricity, and placed above the railing, will furnish an illumination the most splendid, inoffensive, and economical that can be imagined. It seems to us impossible that they will hesitate a moment in adopting it, the more so as the actual mode of illuminating the *two Places* is so inefficient that they are truly plunged in obscurity.

The electric telegraph makes wonderful strides every day. On the 2nd instant we saw, at the Central Office of the Direction of Telegraphs, a simple dial telegraph, invented by M. Alphonse Joly, special agent of the Administration of Telegraphs, work wonders. Through a length of 250 kilometres it prints, at the same time, very rapidly, letters,

figures, and all signs of punctuation, &c. We shall not be much surprised to see this instrument become universal. Without being as rapid as that of Hughes, the *chef d'œuvre* of ingenuity, but which requires a practised hand to work it, and is well adapted for great lines of communication, the telegraph of M. Joly, which prints at once the despatch both at the transmitting and receiving offices, can give from two to three letters per second, from 120 to 180 per minute, a despatch of more than twenty words at the rate of sixty despatches per hour—a velocity sufficient for all secondary lines.

F. Moigno.

PROCEEDINGS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

Owing to the indisposition of Professor Max Müller, on Friday, February 1, his lecture "*On the Language and Antiquities of Cornwall*" was not delivered, and Mr. Scott Russell supplied his place by an interesting lecture upon "*The Late Fire at the Crystal Palace.*" The lecturer divided his subject into three parts—viz., the construction of the building, the fire, and the measures to be taken to remedy the mischief done. The Crystal Palace, as every one knows, is the offspring of the Great Exhibition of 1851, the idea of which undoubtedly belongs in the first instance to the late Prince Consort. After giving some very interesting details as to Sir J. Paxton's original design, and the improvements that were eventually adopted, Mr. Russell proceeded to describe the plan of the construction, which, while giving immense strength, procured that appearance of lightness and elegance which is so marked a feature of the present building. The most essential point is the arrangement of the supporting columns, which are eight inches in diameter and twenty feet long, and the ends of each of which are joined to those of its neighbour by what is known to engineers as a triangular truss girder. In this way each set of four pillars represent the legs of a table, and are kept in position by the girders which form the sides. The whole building is simply a collection of these tables and legs, each one adding strength to all the others, so that any strain on one part is resisted by the combined strength of the whole.

The lecturer, after explaining how the present Crystal Palace grew out of the Exhibition, proceeded to give an account of the fire. The facts are as follows:—There was no fire at 2 o'clock on Sunday afternoon. The fire was first noticed at a period given by different observers at from 5 to 20 minutes past 2. Mr. Russell arrived at the Palace at 10 minutes to 3, at which time the north transept was in a blaze. Seeing at once it was useless to attempt to extinguish the flames, he procured assistance and succeeded in preventing them spreading, being helped towards the last by the London fire-engines. The flames, says Mr. Russell, died away with a celerity that was perfectly marvellous.

The origin of the fire is still very doubtful. The lecturer suggests the following hypothesis:—The tropical department was warmed by pipes supplied from a large boiler underneath the flooring towards the east end of the north transept, and near to where the bark of the large tree was standing. The fireman attending to this boiler banked up his fire, and left it for some hours in the morning. Now, as chemists are aware, the result of putting a large quantity of coal on to a small fire is to generate inflammable gas. This, it is thought, actually took place; the gas found a convenient chimney provided by the skeleton tree, and when a large amount had been produced it caught fire, and immediately became a mass of flame. The building itself, Mr. Russell states, is quite fireproof—that is to say, it will neither burn nor communicate flame, but of course is liable to be injured or destroyed by the burning of combustibles inside it. This is shown by the rapidity with which the flames died out when they were once checked.

The question of what had better be done Mr. Russell decides in a very few words. The Crystal Palace is a great educational work, and as such deserves, and in other countries would receive, the support of the Government. But here the Government does not interfere in these matters. We are proud of being ourselves the government in most respects, and should therefore take upon ourselves the duty of a government in this matter, and by a sufficient subscription preserve this great institution to the nation, with all its original usefulness and beauty unimpaired.

GEOLOGICAL SOCIETY.

At the last meeting of the Geological Society of London, George Maw, Esq., F.G.S., F.L.S., &c., read some "*Notes on some Chemical Analyses of Variegated Strata.*" The author gave the results of some analyses for the determination of iron in the light and dark parts of variegated slates, sandstones, and marls, the colour of which is due to oxide of iron, and in which the variegation appears to be disposed independently of mechanical arrangement. The analysis in each case exhibited the fact that the lighter blotches, spots, and stripes contained a smaller portion of the colouring oxide than the average mass, a proportion which implies an actual difference in the percentage of the metallic iron, and which could not be accounted for by any mere difference in the state of its combination. This shows an actual departure of a part of the colouring oxide out of the colourless patches, and a dispersive process which seemed to be the very reverse of the segregation of nodules of carbonate of lime and carbonate of iron out of a clayey matrix. Among the forms of variegation referred to were: (1st) that resulting from the segregation of dark blotches out of a lighter matrix, the evenness of colour of which does not appear to have been materially affected by the withdrawal of a part of its colouring matter; (2nd) that resulting from the segregation of dark blotches out of a lighter ground, each of which is concentrically surrounded by a distinct and well-defined zone lighter than the general ground; (3rd) strata variegated with light blotches containing a smaller proportion of colouring matter than the general ground, but not arranged concentrically round a darker nucleus; (4th) the variegation of coloured strata with both light and dark blotches, containing respectively a smaller and larger proportion of the colouring oxide than the general ground, but which are not arranged, as in the second case, concentrically with each other.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, January 8, 1867.

Edward Schunck, *Ph.D., F.R.S., President, in the Chair.*

Mr. Binney, F.R.S., F.G.S., exhibited two remarkable fossils discovered by Mr. Joseph Tindall, of Thomas Street, Huddersfield, in the lower coal measures near that town.

The following papers were read:—"*On the amount of Carbonic Acid contained in Sea Air,*" by T. E. Thorpe (Dalton Scholar in the Laboratory of Owen's College), communicated by Professor H. E. Roscoe, F.R.S., &c. The main conclusions to be drawn from this paper may be briefly stated as follows:—1. That the sea does not act in increasing the amount of atmospheric carbonic acid. 2. But that, on the contrary, the air over the sea contains a much smaller proportion of carbonic acid than the air of the land, although the influence of the sea in abstracting

this gas from the atmosphere is not so great as the observations of Vogel and Krüger would indicate. 3. That the mean quantity of carbonic acid gas contained in the normal atmosphere of the ocean is 3·00 in 10,000 volumes of air. 4. That the proportion is constant, or nearly so, in different latitudes. 5. That this proportion is not sensibly influenced by the different seasons of the year. 6. That this proportion does not experience any perceptible diurnal variation.

"*On the amount of Carbonic Acid contained in the Atmosphere of Tropical Brazils during the Rainy Season,*" by T. E. Thorpe. From thirty-one experiments it appears that the mean quantity of carbonic acid contained in the air of tropical Brazils during the months of April and May, 1866, was 3·28 in 10,000 volumes of air—a decided difference from the mean proportion (4·0 vols. in 10,000 of air) contained in the atmosphere of Europe, and probably due in great measure to the joint action of tropical rain and tropical vegetation in withdrawing this gas from the air.

PHYSICAL AND MATHEMATICAL SECTION.

November 8, 1866.

E. W. Binney, *F.R.S., F.G.S., President of the Section, in the Chair.*

Mr. Baxendell, F.R.A.S., read a paper entitled "*Observations of the New Variable Star T Coronæ.*"

Mr. Brothers, F.R.A.S., communicated an appendix to his "*Catalogue of Binary Stars*" presented to the section at its last meeting.

December 6, 1866.

E. W. Binney, *F.R.S., F.G.S., President of the Section, in the Chair.*

Mr. Heelis, F.R.A.S., exhibited some drawings of a hydraulic clock which he had made for the purpose of driving his Equatorial, and described the nature of its action and adjustment, the principal feature being that of using the same water over and over again.

Mr. Brothers, F.R.A.S., communicated an "*Observation of the Occultation of Aldebaran,*" which took place on the 22nd ult.

Mr. Heelis, F.R.A.S., read a paper "*On some Recent Results of Observations of the Specific Gravity of Sea Water.*"

January 3, 1867.

E. W. Binney, *F.R.S., F.G.S., President of the Section, in the Chair.*

"*On the Mean Weekly Temperature at Old Trafford, Manchester, for the Seventeen Years* 1850-1866," by G. V. Vernon, F.R.A.S., F.M.S.

"*On the Rainfall for* 1866 *at Old Trafford, Manchester,*" by G. V. Vernon, F.R.A.S., F.M.S.

"*Results of Observations of Variable Stars made at the Mannheim Observatory during the Year* 1866," by Dr. E. Schönfeld, Director of the Observatory.

PHOTOGRAPHICAL SECTION.

January 10, 1867.

Dr. J. P. Joule, *F.R.S., &c., Vice-President of the Section, in the Chair.*

Mr. Coote exhibited a selection from the series of photographs by Braun, of Paris, consisting of copies of drawings by the old masters from the originals in the Louvre. Mr. Coote explained the method by which they were supposed to be printed, and from the appearance of some of the prints there could be no doubt that one of the processes suggested by Sir John Herschel about the year 1840, or some modification, had been employed; and it was evident that the method proposed by Mr. Gatty would also produce similar results. The prints are remarkable for their perfect resemblance to old drawings and sketches, and, as studies for artists and for use in schools of design, are quite equal to the originals. Of their permanence there cannot be the least doubt.

The following letters from Mr. J. B. Dancer, F.R.A.S., addressed to the Chairman, were then read by the Secretary:—

"1. I am too unwell to attend the meeting of the Section this evening, and have therefore put on paper a few remarks on 'Braun's' copies of drawings of the old masters.

"Mr. Coote kindly showed me these pictures, and my first impression was, that they had been produced by Mr. Swan's process, as it is quite possible to replace the carbon by coloured pigments, and imitate the colour of any chalk, crayon, or even black lead pencil, in the latter case using plumbago. The act of rolling a picture of this kind would give it a lustre like a pencil drawing. There are specimens of this appearance in the collection.

"Having had occasion to write to Mr. Swan, I requested him to give me such information as he possessed as to how these copies were produced. The following is an extract from his reply:—

"'*To J. B. Dancer.*

"'Many thanks for your kind inquiry. Mr. Braun, of Dornach, is printing a number of copies of pictures by my process, in particular a series of Holbein's works; and if this series form a part of the collection to be exhibited at your Society's meeting, they are no doubt by my process. Mr. Braun is, however, also using another process (Rousseau's) for the production of the Louvre pictures, and I think it most probable that all the red pictures, except the Holbeins, are by this process. I do not know precisely what M. Rousseau's process is, but I have heard that it is a modification of one of the processes of Sir John Herschel.

"'You are quite right in thinking my process suitable for the imitation of old red chalk drawings; the shades of colour can be imitated exactly.

"'Mr. Braun is now carrying out my process very energetically, and has erected a steam engine to drive the tissue-making machinery. "'Joseph W. Swan.'

"I think, Mr. Chairman, you will agree with me, when looking over these copies, that they mark a most important advancement in the art of photography. In these productions we have identity in colour as well as in form.

"2. At a meeting of the Photographical Section, October 4, 1866, it may be remembered that I exhibited some specimens of photographs in various colours on paper and calico, a process invented by Mr. John Mercer, F.R.S. I did not recollect sufficient of what Mr. Mercer had told me of the process to give you any definite information as to the production of the colours. A few days since I stumbled on his description; if it is thought of sufficient interest, please to communicate it to the members.

"Mr. Mercer read a paper on the subject at the meeting of the British Association at Leeds in the year 1858. He exhibited coloured photographs on paper and calico, and gave the following directions for producing them:—

"*Directions.*

"34 oz. of sulphate of iron are converted into peroxalate; this is diluted to 2 gallons, and will impregnate 200 square yards of paper. The paper being floated on the solution until fully wet in the usual way, it is then exposed, and afterwards steeped in some solution which only acts on that part where the iron has been reduced from the per- to the protoxide. Red prussiate of potash and sulphuric acid act well, making the image blue and the ground white.

"Sulphocyanide of potassium and a salt of copper form another bath; the protoxide of the picture deoxodises the copper, and the sulphocyanide of the suboxide of copper is fixed in the cambric or paper. This may be converted into the red prussiate of copper.

"A vast number of colours may be obtained by replacing the iron or copper by other metals, such as lead, zinc, tin, mercury, silver, gold, or manganese.

"With these bases may be used various dyes, as madder,

cochineal, murexide, logwood, galls, or quercitron bark, besides the iodides, chromates, prussiates, or oxides of the metals themselves and mixtures of these.

"He also showed how the peroxalate paper might be used as a fair actinometer, by placing a slip between the leaves of a book and pulling it out by steps every stated number of seconds. It is then easily converted into a graduated scale."

NOTICES OF BOOKS.

Water: Its Impurities and Purification. By The London and General Water Purifying Company (Limited). London: Published at the Company's Offices, 157, Strand, W.C. 1865.

This little pamphlet points out the evils attendant upon impure water, both in economy and health, quoting the celebrated case of the Broad-street pump, and then shows that the present water supply of London is far from being so pure as could be desired. To remedy this, the Company propose to suppy filters, invented and patented by Mr. Danchell, which they undertake to furnish and fit up to the existing cisterns on the payment of a yearly rent, to keep them in working order, and to exchange when worn out. Numerous very favourable opinions as to the merits of this filter are quoted from various eminent chemists and others conversant with the subject. Mr. Danchell also supplies a testing apparatus by means of which any one may satisfy himself as to the quality of the water he is using. Considering the importance of pure water, as proved by the late visitation of cholera, we commend these matters to the consideration of our readers.

The Pill Book. By Arnold J. Cooley. London: Robert Hardwicke, 192, Piccadilly. 1866.

Of all the ills that flesh is heir to, upwards of 1050 in the shape of pills and boluses are definitely accounted for by the author of this book, whether they be Pharmacopœial, hospital, magistral, or quack. We read of Analeptic Barbarossa, Rev. D. Barclay's, (ten drugs); Arabian Anticholeraic; Female; Paullinic; Sphariopeptic, or Eli Ahmed's; Mrs. Stephen's; Sulphurated Fuligo Kali; Tobacco and Toothache pills, and others equally mysterious. Strange to say, there are no Abracadabra pills. But there are others that were favourite remedies of Dupuytren, Ricord, Sir Astley Cooper, Sir Benjamin Brodie, and Sir Charles Bell.

As a type of the curious information contained at intervals throughout the volume, we quote the following:—"Everlasting Pills.—Small spheres of metallic antimony of the size of ordinary pills; they possess the quality of purging as often as swallowed with scarcely any sensible diminution in weight. According to some of the old writers, half a dozen of these pills often served a whole family for a life-time, and were handed down as heirlooms to their children."

The weights and measures of pharmacy are most faulty, there being three distinct systems more or less in use. The avoirdupois pound is used by the Dublin and British Pharmacopœias, while the London one, still used, adopts that of the apothecaries' weight. We thus find that in one case the scruple is not recognised as a weight at all; in another it equals 18⅔ gr.; in a third it is equivalent to 20 gr. The whole system is confusing in the extreme. The only rational improvement noticed in the book is the use of granules containing known weights of compounds at the same time of great medicinal use and of fixed chemical composition. Thus, laudanum is made from a certain weight of opium, which may contain 3 or 10 per cent. of morphia, and comparative results will be recorded by different users of the drug. By a new system recommended by such men as Trousseau and Reveil, ⅛th of a grain of morphia in a granule of pure sugar would be given. So with digitaline, corrosive sublimate, or strychnia. These eminent Physicians remark that "their preservation is indefinite, their solution is always easy, and they are well adapted to supplant common pills in the administration of very active medicine. The book is what it professes to be—a *vade mecum* for pharmacists, but, we hope, not for emigrants and travellers; and we are grateful to say that we have no occasion to carry it about with us—more in its praise could not be well written.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Pharmaceutische Zeitschrift für Russland. Heft 7, Jahrgang V. November, 1866.

M. Kubly "*On the Separation of the Alkaloids of Opium in Forensic Chemical Researches.*"—Adolph Fero "*On the different kinds of Rhubarb Roots now met with in Trade in Russia.*"—Glenard "*On the Mode of Estimating the Quantity of Arsenious Acid which may be met with in Magisterium Bismuthi, Subnitrate of Bismuth.*"—Wagner: "*Analytical Researches on the Fluids discharged from those Suffering from Asiatic Cholera;*" "*On the Composition of Urine in Dropsy;*" "*On the Artificial Production of Benzoic Acid.*"—Von Aldenkort "*On the Action of Caustic Potassa on Urine discharged by Persons who took a Dose of Santonine;*" "*On the Fractional Distillation of Liquids.*"—Professor Dr. H. Ludwig "*On an Intestinal Calculus of a Lama;*" "*On the Preparation of Hyoscyamine.*"—Dr. W. Schmid "*On the Action of Hydrogen on Metallic Salts;*" "*On Kreosote;*" "*On the Decomposition of Iodide of Lead by Light.*"—A. Feldmann "*On Laserpitin.*"—Von Corenwinder "*On the Functions of Leaves.*"

Landwirthschaftliches Centralblatt für Deutschland. December, 1866.

"*On the Quantity of Nitrogen Compounds met with in Rain Water, and especially on the Researches ordered to be made in that Direction by the Prussian Minister for Agriculture, &c.*"—Dr. Baron J. Von Liebig "*On the Alleged Existence of Common Salt in American Extract of Beef.*"—Dr. G. de Caux "*On Rain Water for Drinking Purposes.*"—Dr. Letellier "*On the Cause of the Decay of Fruits.*"

Chemisches Centralblatt. No. 70. December 26, 1866.

Dr. E. Heiden: "*Explanation of the Causes which enable Cultivable Soils to Absorb Alkaline Bases.*"—Dr. Lehmann "*On the Phosphate of Urea.*"—"*On the Elimination of Organic Substances from Old Silver Baths (used in Photography?)*"—"*On the Manufacture of Bottles fit to keep Substances affected and decomposed by Daylight.*"

No. 1, 1867.—Rammelsberg "*On Phosphorous Acid and its Salts.*"—A. Lieben "*On the Synthesis of Alcohols by means of Chloride of Ethyl (Gechlortem Æther).*"—Fuchs and Stromeyer "*On the Manufacture of Chloride of Potassium from Carnallite.*"

Le Moniteur de la Teinture et de la Fabrication des Tissus. 1867. No. 1.

"*On the Utilisation of the Residues of the Preparation of Aniline Colours, and the Revivication of the Spent Arsenic Acid.*"

Deutsche Industrie Zeitung. 1867. No. 1.

Dr. Vohl "*On the Impurities met with in Photogen and Paraffin Oils.*"—Von Stolha "*On the Preparation of Sulphurous Acid.*"—Professor Otto "*On the Testing of Chloroform.*"—Persoz, junior, "*On a Substitute for Collodion.*"

Presse Scientifique et Industrielle des deux Mondes. 1867. Par J. A. Barral. Vol. I. No. 1.

Minary "*On Improvements obtained in Cast-iron by the Application of Coke-scoria*, i.e., *a Coke made of* 60 *of Coal mixed with* 40 *of Clinker.*"—Tabourin and Lemaire "*On the Use of Stannate of Soda in the Cleansing and Dyeing of Silk.*"—"*On the Manufacture of Brown and Violet Aniline Colours.*"

Friedrich Georg Mieck's Deutsche illustrirte Gewerbe Zeitung. 1867. No. 1.

A. Vogel "*On the Application for Agricultural Purposes of the Sewage;*" "*On the Estimation of Tannic Acid by means of Gelatin Solution.*"—Dammer "*On the best Mode of Keeping Sodium.*"

Annalen der Landwirthschaft in den Königlich Preussischen Staaten.

Dr. Peters "*On the Manner in which Phosphoric Acid occurs and acts in Arable Soils.*" Dr. E. Heiden "*On the Detection of Hydrates of Silica in Arable Soils.*"

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3423. W. B. Berrey, Liverpool, Lancashire, "An improved composition for cleaning glass and other smooth and bright surfaces."

3432. G. Payne, Battersea, "Improvements in the manufacture of soap."—Petition recorded Dec. 29, 1866.

3448. W. Clark, Chancery Lane, "Improvements in the manufacture of hydrogen gas and in apparatus for the same; also in the application of the said gas for lighting and heating, and as a motive power."—December 31, 1869

Notices to Proceed.

2374. B. Bayliss, Pontnewydd, near Newport, Monmouthshire, "Improvements in the manufacture of iron."—Petition recorded Sept. 15, 1866.

2380. P. Brash, Leith, Midlothian, and W. Young, Straiton, Midlothian, "Improvements in the manufacture of oil from shale and other bituminous substances."—Sept. 17, 1866.

2450. A. F. Stoddard, Glasgow, N.B., "A new or improved fuel."

2452. J. Calvert, Strand, Middlesex, "Improvements in the treatment and manufacture of iron and steel."

2454. J. Gamgee, Queen's Road, Bayswater, Middlesex, and A. Gamgee, M.D., Alva Street, Edinburgh, "Improvements in the slaughtering of animals, with a view to the preservation of their bodies as articles of food, and in the method of preserving animal and vegetable substances."—Sept. 24, 1866.

2496. A. V. Newton, Chancery Lane, "An improvement in the process of distilling petroleum and other oils." A communication from O. Lugo and T. O. L. Schrader, New York, U.S.A.—September 27, 1866.

2568. W. G. Valentin, Royal College of Chemistry, and G. H. Benson, Staleybridge, Cheshire, "Improvements in the manufacture of steel."—October 5, 1866.

2593. G. T. Bousfield, Brixton, Surrey, "Improvements in separating sulphur from soda waste." A communication from P. W. Hofmann, Ph.D., Dienze, France.—October 8, 1866.

2612. G. H. Benson, Staleybridge, Cheshire, and W. G. Valentin, Royal College of Chemistry, "Improvements in the melting and casting of steel, and in the apparatus employed therein."

2614. G. H. Benson, Staleybridge, Cheshire, and W. G. Valentin, Royal College of Chemistry, "Improvements in the manufacture of malleable iron and steel, and in the apparatus employed in such manufacture."

2616. G. H. Benson, Staleybridge, Cheshire, and W. G. Valentin, Royal College of Chemistry, "Improvements in the manufacture of iron and steel, and in the apparatus employed therein."—October 9, 1866.

3106. W. G. Newton, Chancery Lane, "An improved process for extracting oil and paraffin from bituminous substances, such as peat or coal." A communication from S. L. Wiegand, Philadelphia, Penn., U.S.A.—November 26, 1866.

3214. J. Williamson, South Shields, "Improvements in the manufacture of alkalies."—December 6, 1866.

3311. H. Hall, Stacksteads, near Manchester, "Certain improvements in the preparation of size and in apparatus connected therewith."—December 17, 1866.

3355. A. V. Newton, Chancery Lane, "An improved compound for coating ships' bottoms and other surfaces." A communication from C. J. Eames, New York, U.S.A.—December 20, 1866.

3386. H. A. Dufrené, Rue de la Fidélité, Paris, "Certain improvements in the manufacture of the extract of madder." A communication from J. Pernod, Rue des Clés, Avignon, France.—December 24, 1866.

88. R. Mushet, Cheltenham, "An improvement in the manufacture of cast steel."—January 14, 1867.

CORRESPONDENCE.

German Yeast.

To the Editor of the Chemical News.

Sir,—Can any of your subscribers give me a ready way of examining German yeast? A friend has sent me some to examine; he complains that his children suffer from cutaneous disturbance, attributable, as he thinks, either to flour or German yeast. I am not acquainted with the probable impurities in this substance. I have examined his flour, and it is unexceptionable.

I am, &c. G. Y., Subscriber.

Clairvoyance.

To the Editor of the Chemical News.

Sir,—Any of your readers taking the trouble to refer to vol. vii., p. 279, of the Chemical News will find that Professor Wanklyn's newest discovery was accurately foretold by M. Berthelot more than thirteen years ago.

I am, &c. A Subscriber.

Commercial Analyses.

To the Editor of the Chemical News.

Sir,—Mr. Newlands seems to have somewhat mistaken the drift of my communication (page 21); for though it was certainly originated by the letter signed "A Smatterer," it did not profess to be a "reply" to it, but was intended rather to urge a couple of practical suggestions on the notice of analysts.

Surely Mr. Newlands cannot be unaware, as he would seem to imply, of the "discrepancies" (to use the mildest term) between commercial analyses, which often render them "a delusion and a snare." They are, unfortunately, matters of general notoriety, and tend greatly to shake the confidence of practical men in the resources of our science. I can cite an illustration which may, perhaps, possess some extraneous interest.

Some years ago a colliery proprietor in this neighbourhood found seams of what he conceived to be a valuable ore of iron in his coal measures. He had a cheap analysis of it from a "low" analyst of this city, who reported it to "contain 54 per cent. of iron" (the *pure* carbonate contains only 49 per cent.) However, mistrusting his good

fortune, he sent me a sample which I analysed thoroughly and carefully, with the following rather different results :—

The stone was of a dark grey colour, like limestone, and quite homogeneous. It was so hard as to give abundance of sparks under the hammer, and to be extremely difficult to grind down. It was fluxed with carbonate of soda, and the filtrate from the silicic acid reduced again by a little sulphite of soda before separating the oxide of iron and alumina by boiling with potass. As acids had little effect on it, even in the finest powder, a portion was ignited in a closed crucible till the weight became constant, and the loss was calculated for carbonic acid according to the equation—$5(FeO,CO_2)=3FeO,Fe_2O_3+4CO_2+CO$.

Protoxide of iron . . .	28·686*
Alumina	7·776
Lime	·767
Magnesia	3·693
Carbonic acid	14·610
Silica	43·932
Organic matter, &c. . .	·536
	100·000

Upon these results I reported the ore to be valueless, as, besides that the percentage of metal was low, the amount of silica would be very objectionable to the smelter. To bring the matter to a practical issue, my client sent a sample of fifty tons to Dudley, and found that the ironmasters there would only give for it two shillings per ton over and above the cost of transport. The result was, that a large quantity of the material "got" at some expense was thrown away, and the owner was quite ready to confess that the highest-priced analysis was really the cheapest. Numbers of similar cases must be known to every practised analyst.

There is one sentence in Mr. Newlands' letter which is so diverting from its ingenuous simplicity that I cannot pass it over, to wit—"A manufacturer 'of several years' experience' could not well be capable of offering to a professional man an amount which he must be well aware would not repay the latter for the necessary care and trouble bestowed on such analyses." I fancy most analysts, on reading the above and recalling their past experiences, would feel prompted to either a sad smile or a loud guffaw, according to their respective temperaments.

I am, &c. F. W. Griffin, Ph.D.

Bristol School of Chemistry.

MISCELLANEOUS.

Visitors to the Paris Exhibition. — Probably many of our readers have determined to visit Paris during the time of the International Exhibition. It may not have occurred to such, that arrangements for such visits should be made at once, beforehand, but we would press upon all the necessity of making them as soon as they can. The tradesmen and hotel-keepers of Paris are promising themselves a golden harvest, and there is little chance of any arrangement being made with them, unless combined action be at once set on foot. For workmen we are afraid that the visit will be impossible, so high will be the prices for accommodation. From inquiries that we have made, the following seems most feasible, and may be carried into effect if time be not lost. Mr. Thomas Cook, the well-known excursion manager, has obtained reliable assurance for the accommodation of 1000 or more visitors at a time from April to the end of October, at the nearly uniform rate of 10s. a day, for bed, meat breakfast, dinner at *table d'hôte*, and lights, a small charge being added in some cases for service. By a regular succession of visitors in the full numbers, this reasonable scheme may be carried out. We recommend this plan to those who propose a visit to Paris, since we do not think that they will obtain such good terms by private contract—either singly or in parties.

Proposed Use of Soluble Glass.—We see that M. Velpeau has called the attention of scientific men to the anamo-inamovible bandages made by soluble glass, to replace the starch plaster of Paris and glue applications now used for bandaging fractures in England. The great advantage possessed by this glass is that it affords a firmer support, becoming quite hard in two or three hours, at the same time being readily removed by moisture. All these recommendations do not apply to the substances now in use, nor is their application as easy and neat as that of the soluble glass. It can be procured at a very moderate price from Mr. Rumney's Ardwick Chemical Works, Manchester, and we hope that as fair a trial will be given to it in England as has already been done on the Continent. The discovery of this glass was made by Fuch, in Munich; he prepared it by fuzing together sodic sulphate, and charcoal and sand; or either potassic or sodic carbonate with sand. It is of extensive use in the arts for stereo-chromic painting, and protecting substances of all kinds that might be damaged by moisture, &c., from atmospheric action.

Sterro-Metal Alloy Analysed by M. Sommaruza.—This alloy, from the manufactory of M. Rosthorn, exhibits a golden yellow colour, is readily forged like iron, and is easily worked by the file. It consists in 100 parts:

Of iron	4·66
,, copper	55·33
,, zinc	41·80
	101·79

The analysis was made at Vienna, in the laboratory of the Imperial Royal Establishment for Geology.

Visits to Chemical Works.—Dr. Williamson has done much service to the chemical students of his class at University College by taking advantage of the opportunities offered by the metropolis for obtaining practical information about chemical manufactures. During the last winter session excursions were made to such on Saturdays, when the pupils were little engaged, the Professor himself accompanying them, and showing the theoretical bearings of the processes carried on under their eyes. In this manner large gas and soap works, brass foundries, vinegar and oil of vitriol manufactories, among others, were visited, evidently to the satisfaction of all. The amount and kind of knowledge thus obtained can hardly be realised, and we would urge its adoption by all the chemical professors of the various metropolitan medical schools. In this way they will find that their pupils will acquire a much greater interest for the science, and their knowledge will be of a far more practical character. Such a mode of teaching certainly cannot be replaced by any series of diagrams and models, which are so often not looked at, or, if looked at, so soon forgotten. Of course it will be said that there is not time for the student to avail himself of this mode of working, even if he had the chance, from the necessary pressure of other work; but, in answer, it may be said that a few lectures could be dispensed with, and replaced by such excursions. Dr. Williamson has, by thus taking some extra trouble, earned the thanks of the students of his class, and we think that other teachers will soon feel equally thankful to him for showing how easily a new mode of instruction may be worked. There is no doubt whatever that the various manufacturers of London would invite any such friendly inspection with their usual courtesy.

On the Separation of Morphine and Strychnine,* by M. Rodgers.—M. Rodgers has observed that the reaction between strychnine and bichromate of potash may

* Equivalent to metallic iron, 22·311 per cent.; or cast iron, about 23·5 per cent.

* *Journ. de Chim. Méd.*

be masked by morphine. These two bases may be separated, either by chloroform, which dissolves the strychnine, or by benzol, which also dissolves the strychnine, but does not dissolve all the morphine.

Artificial Manure.—The manure applied at the Emperor's model farm, near Vincennes, by M. Ville, is prepared as follows :—

Slaked lime	200 kilos.	cost	2 fr.
Phosphate of lime . . .	400 ,,	,,	80 ,,
Nitrate of soda	500 ,,	,,	200 ,,
Potasse raffinée (carbonate of potash)	200 ,,	,,	190 ,,
	1300 kilos.		472 fr.

The above is the quantity required per hectare.

Recognition of Blood in Medico-legal Investigations.—The following written testimony of Dr. Duffield, of Detroit, in a murder trial in that city some months ago, was published in a late number of the *Detroit Tribune* :—

"Dear Sir,—In accordance with instructions received, I have examined the blood-stains upon the clothes and upon the boat seat sent up to Laboratory.

"The pieces I took from the lining of the right coat sleeve near the wrist afforded evidence of blood. Sections cut from the left leg of the pantaloons (one above the knee, one about at the knee, and one near the bottom of the leg) afford also evidence of blood.

"It was dried quite firmly on to the texture of the cloth, and must by its appearance have been at least six weeks or two months old. On cutting out the pieces from the pantaloons and sleeve, I moistened them with pure glycerine and allowed them to remain six hours. I then pressed out the liquid, drop by drop, as I required to use it, on the glass slip for the microscope, and subjected it to inspection. The blood corpuscles appeared shrivelled and smaller than in fish blood, but still preserved their rounded form and were able to be recognised as the organic features of blood.

"Blood corpuscles of an ox, cow, dog, or any of the mammalia, can be recognised from one another only by their size. On examining fresh blood of an ox and fresh human blood, the human blood will be found to contain the largest corpuscles, and can readily be recognised even on admixture with ox-blood corpuscles, which are smaller; but when time has elapsed, and the blood completely dead on the texture of the cloth, the corpuscles become shrunken, and give, as regards their size, very uncertain results. In the present case, all the corpuscles were round (in the blood taken from the clothes), and therefore belonged to one class—viz., the mammalia, *i. e.*, ox, dog, sheep, cat, &c. It could not belong to birds or fishes, as their corpuscles are oval.

"The spots on the seat were covered over with the eggs of a fish, which I scraped away and came down to dark spots, which had penetrated the wood. I took off the particles of wood with a clean sharp knife and rasped them into a powder, and soaked this powder with glycerine for ten hours. On putting a few drops of the glycerine under the microscope, I found abundant evidence of blood corpuscles, the round ones predominating. There were also oval ones, which could be either fish or bird blood.

"On the conclusion of this investigation I am compelled, though having experimented more or less for six years on the blood of animals, fowls and fishes, to depose that, when dried for any length of time and again moistened, great difficulty will be experienced in attempting to fix its origin by the size of its corpuscles.

"Alfred Russell, Esq." "SAMUEL P. DUFFIELD.

Action of Peroxide of Manganese on Salts of Copper,* by M. W. Schmid.—By shaking peroxide of manganese with a solution of sulphate of copper, a peroxide, CuO_2, is gradually produced, and the manganese dissolves. At the end of three weeks the exchange will be completed, and the filter will retain only a cupreous compound, nearly free from manganese. It is hardly necessary to say that the manganese employed must be perfectly pure. The exchange is made equivalent for equivalent. The peroxide of copper thus formed produces a strong effervescence when, after it has been moistened with a few drops of water, a little sulphuric acid is added. A similar peroxide has been obtained by Thénard by treating oxide of copper with oxygenated water. This is an antozonide, while peroxide of manganese is classed by M. Schönbein among the ozonides.

* *Journ. prakt. Chem.*, xcviii. 137.

Meetings for the Week.

Monday, February 11.

Medical Society, 8 p.m. . . .

Tuesday, February 12.

Royal Institution, 3 p.m. Professor Tyndall, "*On Vibratory Motion, with special reference to Sound.*"

Royal Medical and Chirurgical Society, 8½ p.m.

Photographic Society, 8 p.m. Anniversary.

Wednesday, February 13.

Microscopical Society, 8 p.m. Anniversary.

Thursday, February 14.

Royal Society, 8½ p.m.

Royal Institution, 3 p.m. Professor Tyndall, "*On Vibratory Motion, with special reference to Sound.*"

Friday, February 15.

Royal Institution, at 8 p.m. C. F. Varley, Esq., "*On the Atlantic Telegraph.*"

Saturday, February 16.

Royal Institution, at 3 p.m. G. A. Macfarren, Esq., "*On Harmony.*"

ANSWERS TO CORRESPONDENTS.

Vol. XIV. of the CHEMICAL NEWS, containing a copious Index, is now ready, price 11s. 6d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

Upas.—The first action of the poison of the Upas Antiar is to paralyse the heart. Sir Benjamin Brodie first made this out in 1812.

M. A. M. A. T.—By the ordinary process of cooking, roast meat is more nutritious than boiled, as by the latter operation the juices and salts partly diffuse into the water, whereas in roasting they are kept in the meat.

Medicus.—Chlorate of soda is more soluble than chlorate of potash, and has a pleasanter taste.

Academy of Sciences.—Up to the time of our going to press, the report of the proceedings of the Academy of Sciences on Monday last had not arrived.

W. A. F.—Your ammonia probably contains organic matter. This will account for its solvent action on sesquioxide of iron. Absolutely pure "volcanic" ammonia will not dissolve any trace of iron.

Combustion in Nitrogen.—Lecturer.—Both boron and titanium have been shown to be capable of burning in nitrogen gas with formation of nitrides. We are not aware whether either of these phenomena is sufficiently striking for lecture experiments.

Rusticus wishes for information on the following points :—1. Who was the real discoverer of coal-gas and its properties? 2. Where can I find the best history of illuminating substances generally from the earliest time, including the history of the various improvements in candles, lamps, night-lights, &c.? 3. Where can I find the best historical sketch of the development of photography from it scarliest date to the present time? 4. Where can I find any particulars of the life of Winsor?

Books Received.—The Dictionary of Photography, by T. Sutton, B.A., and G. Dawson, M.A.

TECHNICAL CHEMISTRY.

On a New Process of Organic Elementary Analysis for Substances containing Chlorine, by C. M. Warren.

(Continued from page 64.)

I. *Experiments with Oxide of Lead and with Oxide of Copper, placed in the anterior end of the combustion tube, as absorbents of Chlorine in the analysis of substances difficultly combustible.*

The substance selected for analysis, as a test of the process for that class of bodies which are difficultly combustible, containing but a small percentage of hydrogen, was commercial chloroform. The preparation employed was first subjected to redistillation.

Its boiling point was found to agree essentially with that assigned to pure chloroform in Gerhardt's *Traité de Chimie*. When the usual tests were applied, no impurity could be detected.

Experiment 1.—A mixture of oxide of lead and asbestos was placed in the anterior end of the combustion tube, between *c* and *d*, Fig. 2, as previously described. As chloride of lead was supposed to bear a pretty high temperature, without volatilisation or decomposition, the use of the air-bath was omitted in this experiment, and the oxide gently heated with a small flame from the combustion furnace. The combustion had not proceeded far, when it became apparent, from deposition of minute drops of liquid on the sides of the vacant part of the tube—from *b* to *c*, Fig. 2—that the combustion of the chloroform was incomplete, although no doubt could exist as to the presence of an excess of oxygen. This deposit of liquid, which, as already stated, was supposed to be a chloride of carbon, was found to be difficultly volatile, suffering partial decomposition, and leaving on the tube a brown deposit, which was not entirely removed by ignition in a stream of oxygen. The high temperature employed to burn off this deposit occasioned excessive heating of the posterior end of the mixture of lead oxide and asbestos; and this may have been the cause, to some extent, of the excess in the determinations of carbon and hydrogen, although subsequent analyses indicate that the sample of chloroform under examination contained a larger percentage of these elements—particularly of the latter—than belongs to pure chloroform. This experiment gave 11·47 per cent. of carbon, and 1·87 per cent. of hydrogen. Theory gives 10·07 per cent. of carbon, and 0·85 per cent. of hydrogen. The mixture of asbestos and oxide and chloride of lead was removed from the tube, and treated in the usual manner with a solution of bicarbonate of soda to obtain a soluble chloride. This operation was found extremely tedious. Even after treatment for more than two weeks, with occasional fresh portions of the bicarbonate and frequent agitation, the decomposition of the lead chloride was still found to be incomplete, and the operation was abandoned. As this is given in the text-books as a good process for the separation of chlorine from chloride of lead,* I am led to presume that in this case the excess of heat employed gave rise to the formation of an oxychloride, which is, doubtless, more slowly acted upon by the bicarbonate. This single experiment does not, therefore, prove that oxide of lead may not be employed in this process with good results, when used for easily combustible substances, and excessive heat is avoided. But it will, unquestionably, be found preferable to use a substance which will give directly a soluble chloride.

Experiment 2.—This experiment was conducted as the last, with only this difference—viz., that oxide of copper was substituted for the oxide of lead. No better results, however, were obtained. The reappearance of the difficultly volatile liquid in the vacant part of the tube, while there was assurance of there being no deficiency in the supply of oxygen, served to confirm the impression gained by the preceding experiment—that chloroform could not be completely burnt in oxygen alone, but that a substance having affinity for chlorine would have to be mixed with the asbestos, at the point where the combustion takes place.

II. *Experiments with Oxide of Zinc, mixed with the Asbestos in the posterior part of the Combustion Tube, as absorbent of Chlorine in the Analysis of Substances difficultly combustible.*

As already indicated, the chief object of this set of experiments was to determine whether the presence, at the point where combustion takes place, of an oxide capable of combining with the chlorine would have the effect to prevent the formation of the difficultly volatile liquid above mentioned, and thus remedy that defect in the process.

Experiment 1.—In this experiment three grammes of oxide of zinc were intimately mixed in a mortar with the quantity of asbestos necessary to fill the space between *a* and *b*, Fig. 2, and that part of the tube then packed with this mixture in the usual manner. A similar mixture, composed of asbestos and only one gramme of oxide of zinc, was placed between *c* and *d*. The space between *b* and *c* was still left vacant, in order to be able to observe the effect. On account of the volatility of the chloride of zinc, it was deemed advisable to retain the use of the air-bath to control the temperature of the anterior portion of the combustion tube, which, in this experiment, was not allowed to exceed 160° C. The result was, as anticipated, that no such condensation of liquid between *b* and *c* occurred. In order to gain from this experiment some idea of the degree of volatility of chloride of zinc under such circumstances, the two columns of asbestos were treated for chlorine separately. The solution obtained from the anterior column was found to contain but a trace of chlorine, giving only a milkiness with nitrate of silver; showing that the chloride of zinc does not travel far through a column of asbestos from the point where the flame plays directly on the tube.

Results of the Analysis.—0·2067 gramme of chloroform gave 0·0798 of carbonic acid, 0·0276 of water, and 0·7372 of chloride of silver.

		Calculated.		Found.
Carbon .	C_2	12	10·0671	10·5273
Hydrogen .	H	1	0·8473	1·4514
Chlorine .	Cl_3	106·2	89·0856	88·0455
			100·0000	100·0242

Experiment 2.—In this experiment the whole length of the combustion tube from *a* to *d* was packed with a mixture of asbestos and four grammes of oxide of zinc. The temperature of the anterior end of the combustion tube was regulated, as in the previous experiment, by means of the air-bath.

Results of the Analysis.—0·1339 gramme of chloroform gave 0·0506 of carbonic acid, 0·0156 of water, and 0·4768 of chloride of silver.

* H. Rose, *Chimie Analytique*, new French edition, p. 801.

		Calculated.		Found.
Carbon .	C_2	12	10·0671	10·3062
Hydrogen .	H	1	0·8473	1·2733
Chlorine .	Cl_3	106·2	89·0856	87·9014
			100·0000	99·4809

These two analyses, agreeing as they do so closely, indicate that the chloroform analysed contained larger percentages of carbon and hydrogen—especially of the latter—and a correspondingly smaller percentage of chlorine than the theoretical quantities, occasioned probably by the presence of some impurity. This view is supported by calculations made on the assumption that the excess might have arisen from volatilisation of chloride of zinc, or from incomplete absorption of the chlorine, which would make the chloroform contain from 2 to 6 per cent. more than the theoretical quantity of chlorine. These results are regarded, therefore, as satisfactorily establishing the utility of this process in the analysis of chloroform. But the analysis of this body, containing as it does 89 per cent. of chlorine and only $\frac{80}{100}$ths of 1 per cent. of hydrogen, must be considered as an extreme case, and does not prove the process a good one for other classes of substances.

The next step, therefore, was to determine whether the process would be equally efficient in the analysis of substances rich in hydrogen, the combustion of which would give rise to the formation of a large quantity of hydrochloric acid. The substance selected for analysis, to settle this question, was chloride of amyl.

(To be continued.)

PHARMACY, TOXICOLOGY, &c.

On the Examination of Diabetic Urine; New Reagent for Glucose, by L. B. Francqui *and* L. Vande Vyvere.

After noticing the several reagents used, and pointing out their special inconveniences, the authors propose a solution containing oxide of bismuth as being free from these defects. "We have found," they say, "that hydrate of bismuth dissolves in caustic potash, under the influence of certain organic bodies, such as glucose, cane-sugar, dextrine, tartaric acid, &c." These solutions do not form a precipitate on boiling, except in the case of glucose.

Guided by these results, we are induced to recommend, for the detection of glucose in urine, the following process, which cannot give rise to any fallacy:—

Prepare the reagent by precipitating a solution of acid nitrate of bismuth by a great excess of caustic potash, and pour a solution, drop by drop, into the moderately heated solution until the precipitated hydrate of bismuth is completely redissolved.

To recognise a diabetic urine, heat a portion with the above solution.

After a few minutes' ebullition, the urine becomes brown, and metallic bismuth is then precipitated in the form of a black powder of crystalline appearance, adherent to the glass, if glucose is present.

We have satisfied ourselves that the principles contained in normal urine, such as urea and uric acid, do not precipitate the above reagent. Albumen only causes a brown colour and a slight turbidity, which we consider to be due to the formation of sulphide of bismuth.

Sulphuretted urines also give a black precipitate in a solution of oxide of bismuth in potash and tartaric acid; but this reaction cannot be confounded with that caused by glucose.

It is, besides, easy to recognise and (if desired) to separate the albumen. Thus, on bringing to ebullition the urine of a person suffering from Bright's disease, the liquid becomes turbid, opalescent, and deposits coagulated albumen.

As to sulphides and sulphuretted hydrogen, these are easily recognised by means of hydrate of lead, which these compounds darken.—*Gazette Médicale.*

PHYSICAL SCIENCE.

*On the Ventilation of Icebound Fish-ponds,** *by* Charles Tomlinson, *F.C.S.*

It is, I believe, a common practice when a fish-pond freezes over to break the ice in order that the fishes may obtain a proper supply of air, and it is supposed that if this precaution be neglected the fishes will perish. If this be so, the question arises—How is the icebound water of lakes and ponds far removed from the dwellings of man, where the fishes are not preserved, supplied with air?

On consulting books for an answer to this question, I was surprised to find some contradiction on the part of naturalists of repute. Thus Swainson,† after lamenting the loss of between thirty and forty fine tench, the dead bodies of which were found floating on the surface of his pond on the breaking up of the long and severe frost of 1837-8, says—"The people about the place assert that this mortality would not have happened had holes been broke in the ice for the admission of air; but were this absolutely necessary in all cases, it would follow that the tench of all such ponds as had not been opened would have been likewise killed." Mr. Swainson's own opinion was, that the tench had been killed by cold.

In opposition to this opinion, we must refer to the extraordinary vitality of certain fishes, &c., under the influence of a much lower temperature than we get in this climate. Franklin,‡ during his residence in the Arctic regions, noticed that "the fish froze as they were taken out of the nets, and in a short time became a solid mass of ice. . . If in this completely frozen state they were thawed before the fire, they recovered their animation. This was particularly the case with the carp, and we had occasion to observe it repeatedly, as Dr. Richardson occupied himself in examining the structure of the different species of fish, and was always in the winter under the necessity of thawing them before he could cut them. We have seen a carp recover so far as to leap about with much vigour after it had been frozen for thirty-six hours." Hearne, Ellis, and others state that mosquitoes and other insects frozen into a black solid mass, spiders frozen so hard as to bound from the floor like a pea, frozen leeches, frogs, and snails, all recovered their energies when thawed before the fire. Mr. Jesse also relates the case of a golden carp recovering after having been completely frozen in its vase of water.

These facts seem to prove that although fishes may be made torpid by cold, and so not require air, yet in their active state they must be supplied with this necessary condition of life. The appetite for air is, no doubt, different in different species. If carp and tench in an aquarium

* Communicated by the author.

† "Natural History of Fishes, &c.," in the "Cabinet Cyclopædia," vol. i. p. 50.

‡ "Journey to the Shores of the Polar Sea, 1819-22," p. 248.

be watched, it will be found that the carp frequently seek the surface for air, while the tench remain at the bottom. If various species be crowded together in a tub of water, such as minnows, dace, roach, gudgeons, &c., some will die long before the others for want of air. I remember seeing one morning, in the market-place of Cologne, tubs of water crowded with carp. They did not attempt to move about, but remained with their mouths just out of the water, imbibing the air. I was told that it is the practice to return to the stews until the next market-day the fish that had not been sold. I have also read of carp being kept alive all the winter, hung up in nets in cellars with wet moss about the gills, the moss being occasionally sprinkled with water.

Boccius,§ a practical manager and constructor of fish-ponds, distinctly recognises the necessity of supplying air to the water during frost. He directs that a hole, about two feet in diameter, be opened in the ice, and that a faggot of sticks, or of brushwood, be inserted in the hole to keep it open and shelter it from the wind. Mr. Swainson's pond already referred to was "fringed with many aquatic plants," and the only use assigned to them is "abundant shelter thus afforded to the fish," whereas one purpose served by such plants is to keep the water longer in a liquid state.

But perhaps it may be said that in stews and preserves the fishes are much more crowded than they are likely to be in a state of nature, and hence the necessity for making holes in the ice. The crowded state of the aquarium prevents the proper ventilation of the water, and this I believe to be the main cause of the failure of that interesting institution. I know of several curious cases of failure, all referable to want of air. One kept in a house in a crowded thoroughfare failed, as I think, from the constant vibration loosening the adhesion of the air to the water. The fishes were always at the surface gasping for air, and repeated syringing of the water did not remedy the mischief.

Referring to the experiments reported in last week's Chemical News on the freezing of aerated waters, it appears that when such waters are frozen rapidly, the air becomes entangled, and opaque, milk-white ice is the result; but where the cold operates gradually, clear crystalline ice, from which air is excluded, is formed; or, if the air cannot escape, clear ice is first formed, and afterwards the opaque aerated ice. Similar effects are produced in nature. In a shallow pond a sudden frost will produce much of this opaque ice; the inhabitants will be deprived of air, and thus be suffocated. A few years ago a friend wrote to inform me that a considerable number of the small blue roach had been killed in the ponds (or pits, as they are locally called) about Bromborough, near Birkenhead, from the sudden freezing over of the surface. These pits are shallow, and a sudden frost would entangle much of the air of the water in the ice. On the other hand, if the cold increase gradually, the water has time to separate the air, and no sooner is a thin crust of ice formed on the surface than this separation proceeds downwards, and often with such effect as to collect the air in lenticular masses, which appear of a light colour amidst the black ice. In this way the freezing proceeds downwards, and if the water be moderately deep, the fishes not only enjoy a comparatively mild temperature, but have air enough until the frost breaks up, unless, indeed, it be of unusual duration.

Deep ponds and lakes are slow in freezing, because the whole body of water is slow in attaining its maximum density by cold, and until this is done the surface cannot sink to 32°. On the other hand, rivers and streams are slower in freezing than stagnant shallow water, the motion interfering with convection and also with crystallisation. Ponds and lakes are often fed by springs and streams, so that if the former be frozen on the surface the latter may be active, and, if they find their way into the icebound water, will carry in much air.

Mr. Kohl‖ refers incidentally to the powerful currents under the ice of Lake Superior. He is describing the method adopted by the natives for spearing sturgeon. A fisherman cuts a hole in the ice about two feet in diameter, builds over it a hut of bush work, and covers it with a cloth. This serves for sheltering and concealing his body. The light passes through the transparent ice, and illuminates the waters to a great distance around. These waters are so transparent that he can see to a distance of forty or fifty feet. The spear is from thirty-five to forty feet in length, and is attached to a line. Armed with this, and aided by an assistant, he watches the currents that occur in many parts, and in which the finest sturgeon are found. The fishes generally move up the stream at various rates of speed, either quickly or slowly, or they stop altogether, until, being within reach of the spearsman, one is struck and secured. Other fishes are enticed nearer the surface by means of artificial decoy fish of wood or bone.

In smaller collections of water, where the temperature is low enough to lock up the springs, air may be supplied by a portion of the water sinking into the soil. There is a phenomenon common in country lanes when a sharp frost sets in immediately after rain. The water that collects in the wheel-ruts and in the hoof-prints of horses, &c., freezes at the surface in blades of ice that cross at angles of 60°. If this ice be tapped with a stick a few hours after it has been formed, it will be found not to cover water, but a hollow space from which the water has been absorbed by the soil. This kind of ice is called "cat's ice" by country people, probably from its treacherous nature.

If a portion of the water of a pond or lake be thus absorbed by the soil, the ice is left unsupported, except at the edges, and air would find its way in either through cracks in the ice or through the soil. A moderately porous soil would let in air. Indeed, it has been proved by the experiments of Messrs. Pettenkofer and Roscoe that a brick wall by its porosity is an important aid to ventilation, "an actual and very large diffusive interchange going on within the pores of the brick and mortar."

If what I have said is not enough to show how icebound fish-ponds are ventilated, I shall be glad if some of the readers of the Chemical News will throw a little further light on the subject.

Highgate, January 31.

The Abbe Moigno, on Monday evening, was invited by H. M. the Emperor to give an evening lecture at the Tuileries, on electricity, before the Court. All the modern appliances of the fluid were treated upon by the learned lecturer, whose profound knowledge is combined with a charming ease and grace of diction. Several times he was complimented by the Empress on the success of his experiments.

§ "On the Management of Freshwater Fish."

‖ "Wanderings around Lake Superior." 1860.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, February 11, 1867.

Last year a very forcible powder was proposed, consisting of chlorate of potash and tannic acid, but which was far too detonating. Dr. Borlinetto, Professor of Chemistry at the University of Padua, had the idea at first to substitute gallic acid; the powder became less violent, but it was still too detonating. From gallic acid he passed to picric acid, very rich in carbon; a mixture of two equal portions, well pounded together, of chlorate of potash and picric acid forms a powder which detonates, emitting a very bright white flame, but which is still too dangerous, as a slight pressure is sufficient to cause it to explode. It was absolutely necessary to abandon the use of chlorate of potash. M. Borlinetto substituted for it the nitrate of potash; and the following mixture—

Nitrate of potash	. .	10 parts
Picric acid	. . .	10 ,,
Bichromate of potash	.	8·5 ,,

gave an excellent powder, that can be compared with the best sporting gunpowder. These three substances should be intimately mixed. There is no danger of this powder exploding by friction or percussion; it leaves scarcely any residue after combustion. The bichromate of potash is absolutely necessary in order to give it expansive force. The nitrate of potash is decomposed at a red heat into oxygen and nitrite of potash; at this same temperature a portion of the oxygen of the bichromate of potash unites with the carbon of the picric acid, giving rise to a white heat, which completes the decomposition of the nitrate of potash.

Paper lightning-protectors for telegraphic lines are now attracting attention They consist of two well-smoothed brass plates from 25 to 30 square centimetres (3·87 to 4·65 square inches) placed one above the other, and separated by a sheet of paper; one of the metal plates is in connexion with the line, the other communicates with the earth. As soon as a rather strong tension occurs on the line, sparks pass from one plate to the other, perforating the paper, and the electricity passes into the earth very easily. M. Guillemin proposes to replace the paper by a very thin layer of mica. The mica is a better insulator; it does not absorb damp; it cannot produce carbon, since it is of a mineral character; moreover, its ready cleavage allows of its being split into plates thinner than a sheet of paper. The administration of the telegraphic lines purpose placing very shortly a great number of these lightning protectors in places subject to be attacked most frequently by the electric fluid of the atmosphere. Practical trial is the only method by which the modification proposed by M. Guillemin can be appreciated. We hope the results will be favourable.

When Nichol's prisms are used as polarisers or analysers in delicate optical measurements, a very strange anomaly may be at once remarked: the azimuths of extinction do not occur at a distance of 180°. The error can amount to several tens of minutes. This error would be fatal to the use of the Nichol's prism, if we could not discover the cause, diminish, and remedy it. M. Cornu first pointed out this cause, and he has given the following explanation. The axis of rotation of the prism, or rather that of the instrument which carries it, does not coincide with the plane of the principal section; hence the ray which traverses takes different directions in the prism according to the azimuth, and the polarisation that it is subject to is not parallel to the plane of the optical symmetry of the crystal. When the lines of entry and quitting the prism are quite parallel, it can be regulated by trial; in general the error will be only attenuated and not annulled. It is eliminated in proceeding by crossed observations. In fact, it is easy to demonstrate, by a very simple calculation, and by direct observation, that the error e of the normal azimuth is given by the formula

$$e = A(z + a);$$

A and a being the constants; z, the observed azimuth. We easily deduce that the mean of the reading of the azimuths, which should strictly differ by 180°, gives, after the subtraction of 90°, the real azimuth. The error is eliminated of its own accord, if we choose for the measurements of the azimuths the mean of two positions of extinction, whether for the analyser or for the polariser.

The scientific world has made during these last weeks a truly extraordinary discovery, which has made known the real nature of the swarm of shooting stars which are seen in the nights of August 10 to 11, and of November 13 to 14. M. Schiaparelli, Director of the Brera Observatory at Milan, was the first to give the character of a true theory to the opinion put forth by Kepler, and which attributed a stellar origin to shooting stars. The showers of August and November were formerly spherical nebular masses, arriving from the regions whence come the comets, and which, under the influence, at the same time attractive and perturbative, of some great planet, became considerably elongated at the same time that they began to describe a very oval elliptical orbit, which brought them periodically within the sphere of attraction of the earth and under the oxidising and igniting influence of the terrestrial atmosphere. In the meteorological bulletin of the observatory of the College of Rome for December 31, 1866, M. Schiaparelli gave the following elliptic elements of the orbit of the shower of August 10 :—

Perihelion passage . . .	10·75 d. August.
Longitude of perihelion . .	343°28′
Longitude of ascending node . .	138°16′
Inclination of orbit . . .	64°3′
Perihelion distance . . .	0·9643

Motion retrograde.

M. Schiaparelli was also the first to make known the almost perfect identity of these elements with those of the great comet of 1862, such as they result from the last calculations of Dr. Oppolzer :—

Perihelion passage . .	22·9 d. August, 1862.
Longitude of perihelion .	344°41′
Longitude of ascending node .	137°27′
Inclination of orbit . .	66°25′
Perihelion distance . .	0·9626

Motion retrograde.

It is impossible to think that this coincidence can occur by chance. The comet of 1862 essentially forms part of the shower of falling stars. In this same letter, of December 31, M. Schiaparelli gave the elements of the very elongated orbit of the shower of falling stars of November 13. Up to that period M. Le Verrier had announced nothing. It was only on the first days of January that he announced that, at the meeting of the Scientific Society of France on January 14, he would treat upon the origin of shooting stars. In fact, he made a communication upon this subject soon after, followed (January 21, 1867) by a lecture at the Academy of Sciences, in which, without the slightest mention of M. Schiaparelli, he reproduced his theory: this swarm of asteroids has come to us from the depths of space, and in the interval of each of these returns it returns towards the superior planets. A body coming from a distance, animated with a great velocity, at the moment when it attains the minimum distance of the earth from the sun, could not be fixed by the feeble action of the inferior planets, in an orbit of one or two years. We are convinced of this by calculation, and we find a physical proof of it in the fact that the shower of falling stars which repasses the earth every thirty-three years is not completely deranged in the *ensemble* of its orbit; otherwise it would not be seen at regular intervals. Admitting, then, that the shower circulates in an orbit of 33¼ years, that the perihelion distance is equal to 0·989

of the radius of the terrestrial orbit, at the mean of the apparitions we have for the first elements of the orbit :—

	Years.
Duration of the revolution . .	33·25
Semiaxis major	10·34017
Eccentricity	0·904354
Perihelion distance	0·989000
Inclination of orbit	14°41′
Longitude of ascending node .	51°18′
Longitude of perihelion . . .	42°24′

These elements differ so little from those of M. Schiaparelli, that all the glory of the discovery can be attributed to him. The following is all, in reality, that M. Le Verrier added to it (*Comptes Rendus* of the Academy of Sciences, vol. lxiv. p. 97) :—

"The mass of shooting stars could not have been introduced and thrown into its actual orbit, except by some energetic disturbance. . . . We cannot be otherwise than struck with the circumstance that the shower of November extends as far as the orbit of Uranus, and a little beyond it; the more so as these orbits cross each other, nearly at a point situated, after the passage of the swarm, at its aphelion and above the plane of the ecliptic. We are then bound to inquire whether Uranus and the cluster of asteroids could not have been situated simultaneously at this point—that is to say, in the neighbourhood of the node of the orbit. . . . To resume, all the phenomena observed can be explained by the presence of a globular cluster cast against Uranus in the year 126 of our era, in the orbit which observations assign to the mass of asteroids of November. . . . The action of Uranus must have unequally changed the absolute velocities of the corpuscles, and this action surpassing the attraction resulting from their total mass, the cluster became disengaged and extended over the whole periphery of the ellipse, &c." Thus, the problematic interference of Uranus in the year 126 of our era is all that belongs to M. Le Verrier in this question. We say *problematic*, because the passages quoted by M. Schiaparelli from the ancient Indian poems seem to show that the shower of shooting stars of November 13 had been observed long before the year 126 of our era.

M. Le Verrier did not confine himself to the communication of the Scientific Association of France, at the Academic Lecture of January 21; he gave to his conjectures the solemnity of a letter, addressed to his illustrious colabourer in the field, Sir John Herschel, inserted in the *Moniteur*, and in which, faithful to his antecedents, he was silent as to the name of M. Schiaparelli, and attributed all the merit to himself of an explanation which only belongs to him by virtue of a very secondary hypothesis. We are very sorry to be obliged to acquaint our readers that the tactics of M. Le Verrier have been crowned with the most complete success, and that the venerable patriarch of Collingwood has fallen into the mistake. In the answer, also inserted in the *Moniteur*, M. Schiaparelli does not even appear in the background, and all the praise is given to M. Le Verrier. We ask all our brother members of the press to unite with us in condemning a really unjust spoliation. M. Le Verrier has trampled under foot all the laws of scientific probity, in not taking into any account whatever the publications made by M. Schiaparelli in the meteorological bulletin of the Roman College, and especially of the second, reproduced entirely in *Les Mondes* of January 26, and which is a complete mathematical theory of the observed phenomena.

Since the communication of M. Le Verrier, M. Schiaparelli at Milan, and M. Paten at Altona have called our attention to the truly extraordinary identity of the elements of the shower of stars in November with those of the comet of M. Tempel (first comet of 1866), also recently mentioned by M. Oppolzer.

	Years.
Duration of the revolution .	33·18
Semiaxis major . . .	10·32479
Eccentricity . . .	0·905420
Perihelion distance . .	0·97652
Inclination	17°18′
Long. of ascending node .	51°25′

Motion retrograde.

We do not know that a more unlooked-for and extraordinary fact in the history of astronomy can be cited than that of the identification of the orbits of these two showers of shooting stars of August and November with the orbits of two comets which have recently appeared, as demonstrating the most astonishing of approximations. Let us repeat again that the glory of this brilliant discovery belongs wholly and entirely to M. Schiaparelli, and that M. Le Verrier can only claim the merit of a conjectional perception of it. F. MOIGNO.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, February 7.

Professor W. A. MILLER, *M.D., V.P.R.S., President, in the Chair.*

THE proceedings were opened in the usual manner, and the following gentlemen were balloted for, and duly elected Fellows of the Society, viz. :—James William Hudson, Ph.D., F.S.A., Principal of Trafford College, Manchester; Mr. Joseph Ince, Associate of King's College, London, and Member of Council of the Pharmaceutical Society, 26, St. George's Place, Hyde Park Corner; Mr. George Ottley, 196, Walworth Road. The candidates whose names were read for the first time were—Major R. C. Stewart, Deputy-Assistant Adjutant-General to the Forces, Horse Guards, and 12, Prince of Wales's Terrace, Kensington Palace; Mr. William Price Bonner, 69, Mark Lane; Mr. James Campbell Brown, 65, Bon Accord Street, Aberdeen; and Mr. J. Hersee Freeman, Stratford House. For the second time were read the names of Mr. Jonathan Hearder, Plymouth; Mr. Henry Watson Eve, M.A., Wellington College, Wokingham; Mr. William Thurston Waite, 37, Jewry Street; Mr. Martin Henry Payne, 47, Mortimer Street, Cavendish Square; Mr. Frederick George, of Cheltenham; Mr. R. R. H. Davey, War Office, Pall Mall.

A "*Note on some Varieties of Orchella Weed and Products obtained therefrom*," by JOHN STENHOUSE, LL.D., F.R.S., was read by the Secretary. The author commences by referring to a previously described gigantic variety of *Rocella tinctoria*, known as "Valparaiso weed,"* and to the fact of Gerhardt having suggested (with truth) the identity of the orsellic acid prepared from it and the lecanoric acid of Schunck. The preparation of orcin and erythrite are then treated of, and for this purpose the weed is exhausted with lime-water, or milk of lime, when, upon addition of hydrochloric acid, erythrin is precipated. This intermediate product is then boiled with fresh milk of lime in an apparatus provided with a long condensing tube so as to guard against the action of air, submitted to carbonic acid or sulphuric acid to remove the lime, and evaporated cautiously to dryness. The orcin is then extracted from the mixture by repeated treatment with warm benzol, and the residue is boiled with water, filtered when cold, and evaporated, in order to furnish the erythrite. When purified, the orcin forms colourless crystals, soluble in water, which were found to yield an amorphous yellow product by the action of chloride of sulphur. *Orsellinic ether* was obtained by boiling the pasty erythrin with alcohol, and afterwards purified by dissolving in hot benzol. From this body the *di-iodorsellinate of ethyl* was procured by the action of a dilute solution of chloride of iodine. It was crystallised from bisulphide of carbon, and, finally, from spirit in small needles,

* *Phil. Trans.*, 1848, page 63.

which are very slightly soluble in water. A combustion of this substance was made. The analytical results established the formula, $C_8H_5I_2(C_2H_5)O_4$. Dr. Stenhouse describes the corresponding methyl-compounds, and also refers to a modification of his method of determining the amount of colour-yielding principles in lichens by the employment of a standard solution of hypochlorite of sodium.

A paper "*On the Eggs of Corixa mercenaria*," by Dr. T. L. Phipson, was read by the Secretary. These eggs were said to be abundantly deposited by the insect (a kind of boat-fly) upon reeds growing on the banks of certain fresh-water lakes in Mexico, and were collected, dried in the sun, ground into a kind of flour, and used by the natives as a nutritious food. The structural character of the eggs is illustrated in the author's paper by a sketch. They appear to be smaller than a pin's head; and by microscopical examination it was ascertained that the *larvæ* had escaped, leaving only the rigid envelope, submitted to analysis, and found to contain 6·2 per cent. of nitrogen. The eggs of the *corixa* are said to be composed almost entirely of chitine, with only 5 per cent. of mineral matter (chiefly phosphate and carbonate of lime). The author disputes the view advanced by Fremy, to the effect that chitine is a kind of cellulose, at the same time stating his belief that it is a glucoside, $C_{18}H_{15}NO_4$, yielding glucose and lactamide (or some such body) by the action of mineral acids. M. Virlet d'Aoust describes the occurrence of these eggs as contributing towards the formation of a new oolitic limestone rock at the bottom of the Mexican lakes.

The President moved a vote of thanks to the authors respectively, and invited Dr. Matthiessen to deliver a lecture "*On Alloys*."

Dr. Matthiessen commenced by defining an alloy to be "a solidified solution of one metal in another." The metals might be conveniently divided into two classes, according to whether or not certain physical properties of the constituents reappeared in the compound. The metals in the first class (A) were lead, tin, zinc, and cadmium; in the second class (B), all the rest. If either of these four metals were alloyed amongst themselves, the metallic mixture always presented physical characters, which were the mean, by weight or volume, of the component metals. Zinc and lead would not unite to form alloys, or only in minute proportion could one metal be dissolved in the other; thus lead was saturated by 1·6 per cent. of zinc, and, conversely, zinc by about 1·2 per cent. of lead. If equal weights of the two metals were melted together and allowed to cool very slowly in a cylindrical mould surrounded by hot sand, the separation was almost complete, the heavier lead subsiding to the bottom. The case of zinc and bismuth was somewhat similar; only 2½ per cent. of zinc could be dissolved in bismuth, whilst a variable quantity, from 8 to 14 per cent., of bismuth was taken up by zinc. Alloys did not, in the lecturer's opinion, come within the definition of true chemical compounds, but were intimate mixtures, perfectly homogeneous throughout, like ordinary glass. There might be a few exceptional cases, such as the sodium amalgam, in the production of which heat was given out, so also with platinum, or gold and tin; but the addition of lead to melted tin had a cooling effect, and copper dissolved but very slowly in the latter metal, although the copper-tin alloy had new and remarkable properties. Dr. Matthiessen then proceeded to illustrate by experiment the fact of the specific heat of the copper-tin alloy being the mean of the specific heats of the metals composing it. For this purpose two short cylinders were taken; one was the copper-tin alloy (gun-metal), and the other a compound bar of the same weight, made up of a cylinder of copper joined to one-tenth of tin. These were suspended by string in boiling water, and heated together for a few minutes, then withdrawn and cooled in two identical cups of cold water. By a differential thermometer, in the shape of the letter M, the rise in temperature of the water was shown to be in both cases exactly equal. A similar experiment, made with lead and zinc of equal weights, at once indicated the fact of the specific heat being greater in the case of zinc. The rate of expansion by heat was shown by a modification of Daniell's pyrometer, the gun-metal and compound copper and tin bars being surrounded by a glass tube charged with steam. In both instances the needle was deflected to the same extent. The lecturer then referred to the crystalline form and fusing points of alloys; these were characters upon which the chemical view had usually been based, but a lower fusion temperature was common to all mixtures. Thus the alloy of potassium and sodium was permanently liquid like mercury, a mixture of their chlorine compounds, or, indeed, of any two metallic chlorides fused lower than the mean temperature; so also did the mixed fluxes employed in metallurgical operations. Mr. Cooke has stated that alloys of antimony and zinc, containing from 43 to 64 per cent. of the latter, crystallise in a different form from all the rest. The same had been said of the gold-tin alloy containing from 27 to 43 per cent. of gold. With regard to the copper-zinc alloys, the lecturer said that they all crystallised in the same form, and that therefore definite forms could be obtained when the constituents were not in atomic proportions. The properties of heat and electric conduction were next treated of; these were said by MM. Wiedemann and Franz to be alike. A comparative experiment was then shown, which indicated how rapidly the conducting power of copper for heat was destroyed by the introduction of a metal of Class A, such as tin, whilst the lead-tin alloy presented the mean result of the component metals. The results were as follows:—

	Heat-conducting power.
Copper	100
Copper-tin alloy	8
Tin	12
Lead-tin alloy	11
Lead	8

Several very interesting observations were brought forward by Dr. Matthiessen in connexion with electric conductivity of alloys. The metals of Class A are all bad conductors, and when alloyed with each other they conduct electricity in the ratios of their relative volumes. (Indicated by straight lines in the diagram.) Metals of Class B, such as gold and silver, do not, when alloyed with each other, conduct in the ratios of their relative volumes, but always in a degree inferior to the calculated mean. (Shown in the diagram by a rapid decrement on *both* sides of the curve.) The alloys of metals in Class A with one of those in Class B (for example, the copper-tin alloy) are like the last, but they show a very rapid decrement on the side of the metal belonging to Class B (to the extent of 85 per cent. copper in the instance quoted), then running in an almost straight line to the other side, representing the metal (tin) of Class A. In other words, there is very little difference between the conducting power of gun-metal and of pure tin, although copper itself is eight times better than tin. The sonorous qualities of metals and alloys were next taken into consideration. Bars of copper, tin, and a tin-copper alloy, when struck, all emitted a dead sound, but gun-metal gave a clear ringing tone. Brass rings well, but zinc is dull. Steel is infinitely superior in sonorous quality to malleable iron. Elasticity was then exemplified by hanging weights to a series of metallic wires twisted in a spiral form. Copper was straightened by a weight of 500 grammes, and tin by 50 grammes; but the copper-tin alloy supported the 500 without loss of figure. The difference between pure gold wire and gold with copper was very marked; so also the silver-platinum alloy proved greatly superior in elasticity to either of the individual metals. Spirals of hard-drawn malleable iron and steel showed, of course, the extremes, with least variation in chemical composition. Tenacity was shown by the help of a draw-

bench with spring balance attached. The experiments had to be rapidly performed, and the results were only true, therefore, between somewhat wide limits. The breaking weights of wires of equal diameter, 23 wire gauge (Birmingham), were nearly as follows:—

Copper wire, hard drawn .	about 30 lbs.
Tin	under 7
Copper-tin alloy (hard-drawn)	. 80 or 90
Tin-copper alloy . . .	about 7
Lead	under 7
Lead-tin alloy . . .	about 7
Gold (hard-drawn)	. 25 or 30
Gold-copper alloy ,, .	. . 80
Silver ,, .	about 50
Platinum ,, .	. ,, 50
Silver-platinum ,, .	. ,, 80
Iron ,,	. about 80 or 90
Steel ,,	upwards of 200

The lecturer proceeded to show how completely the scientific deductions coincided with the results of practical experience; thus the "turning-points" indicative of marked physical properties were found to mark the proportion of metals entering into the composition of a variety of useful alloys. Thus, in

Brass, 28 per cent. of zinc.
Gun-metal, 12 per cent. of tin (approximately).
Gold of 22 carat standard (with copper).
Dental alloy of silver and platinum.

The last-named alloy had been chosen as the standard for electrical resistance by the British Association Committee. The sound and electrical curves differ only by 5 per cent. in the case of the copper-tin alloy, and other physical characters are marked in gun-metal; but the lecturer hesitates to accept the expression $Cu_{14}Sn$, which would be demanded on the assumption of its being a chemical compound. Whilst the metals of Class A produce alloys having normal physical properties, those of Class B are so entirely changed by admixture of small quantities of other metals that the resulting alloys can only be viewed as "solidified solutions of allotropic modifications of the metals in each other." Dr. Matthiessen concluded by referring to the discovery of a new factor, which, if multiplied by the number representing the conducting power of a metal alloyed with it, expresses the electric value of such metal in the alloy. The process is illustrated in the following diagram:—

Conducting Power, in terms of British Association Unit, Metre Length, Millimetre Diameter.

Metals.

Copper	47·50
Zinc	13·80
Tin	5·88
Lead	3·96
Bismuth	0·60

Alloys containing

Copper tin . .	4·190	·851 Cu	·149 Sn
Copper zinc . .	10·330	·706 Cu	·294 Zn
Bismuth tin . .	0·117	·991 Bi	·009 Sn
Bismuth lead . .	0·122	·982 Bi	·018 Pb

Values obtained for Conducting Power of

Copper from 1st alloy . . .	3·89
,, ,, 2nd ,, . . .	8·89
Bismuth ,, 3rd ,, . . .	0·0677
,, ,, 4th ,, . . .	0·052

$$\begin{array}{c} \cdot 149 \times 5 \cdot 88 = 0 \cdot 88 \\ 4 \cdot 19 - 0 \cdot 88 = 3 \cdot 31 \\ \frac{3 \cdot 31}{\cdot 851} = 3 \cdot 89 \end{array}$$

$$\frac{3 \cdot 89}{5 \cdot 88} = 0 \cdot 662 \qquad \frac{0 \cdot 0677}{5 \cdot 88} = 0 \cdot 0115$$

$$\frac{8 \cdot 89}{13 \cdot 8} = 0 \cdot 664 \qquad \frac{0 \cdot 052}{3 \cdot 96} = 0 \cdot 0130$$

Conducting Power of

Copper = 0·650 × conducting power of metal alloying it.
Bismuth = 0·012 × ,, ,, ,, ,,

Professor Graham referred to the circumstance of the metals in Class A being those which are attacked or diffused into mercury by virtue of an action similar to that of salt into water. He thought, therefore, that Dr. Matthiessen's view regarding the constitution of alloys was borne out by reference to analogous cases of union.

Dr. Odling remarked upon the difficulty of stating exactly the conditions upon which a chemical compound might be formed. There were so many degrees of affinity exerted between different elements that it was necessary to define the term "chemical compound" before it was possible to say whether or not the class of actions involved in the formation of alloys was comprehended. He would not say that the metals united with the affinities of oxygen for hydrogen, but he considered that the force in question was comparable with that occurring during the solution of salt in water.

Dr. Matthiessen quoted, in reply, the case of sulphur and copper, which produced a definite compound, from which any excess of the first-named element could be driven off by heat. In the case of alloys, it was found impossible, as a rule, to produce combinations of definite character. Thus, in the case of the gold-tin alloys, he had obtained five crops of crystals of definite form, but not of constant chemical composition.

The President moved a vote of thanks, carried by acclamation, and adjourned the meeting until the 21st inst.

PHARMACEUTICAL SOCIETY.

February 5, 1867.

T. H. Hills, *Esq., Vice-President, in the Chair.*

The first paper read was one "*On the Preparation of Spirit of Nitrous Ether*," by Professor Redwood. The author commenced his paper by alluding to the various published processes for the preparation of spirit of nitrous ether, referring more especially to the process of the London Pharmacopœia of 1851. He mentioned that, although spirit of nitrous ether had been much used as a medicine for many years, there had hitherto been no satisfactory mode of preparing it, the strength varying from one to twelve per cent. When the British Pharmacopœia of 1864 was issued, it was hoped that a process would be given which would enable manufacturers to produce spirit of nitrous ether of a uniform strength, but such was not the case; for, although on reading the process it appeared to be an improvement, it was found to be impossible to produce the nitrate of soda of a uniform composition. Professor Redwood then proceeded to explain the process of the forthcoming new edition of the British Pharmacopœia, which consists in mixing 2 oz. of sulphuric acid and 2½ oz. of nitric acid with 1 pint of rectified spirit, pouring the mixture into a retort containing 2 oz. of fine copper wire, and supplied with a thermometer, allowing 15 oz. to distil over, and then adding 40 oz. of rectified spirit. This process appears to be very simple, and even more economical than former Pharmacopœia processes, so that it is likely to be successfully followed by wholesale manufacturers. The advantage is, that with a small quantity of nitric acid a mixture is obtained which will yield nitrous ether in a constant quantity and of a certain strength, sulphate of copper remaining in the retort. Professor Redwood explained that the process did not yield a pure spirit. He hoped to pay more attention to this at a future time; but it would have been unadvisable to have introduced into the Pharmacopœia a pure spirit of nitrous ether, when it was not known whether spirit of nitrous ether owed its medicinal qualities to the nitrous ether or to the aldehyd it contained.

Mr. Watts then read a paper on "*A Critical Examination of the various Published Processes for the Estimation of Tannin.*"

ACADEMY OF SCIENCES.

February 11, 1867.

"*On the Isomeric States of Silicic Acid, and on the Polyatomicity of Acids*," by E. Frémy.

The importance of the phenomena relating to polyatomicity is well known to all the world; they interest equally in reference to mineral substances as well as organic bodies; they bear a strong relation to the study, so important, of isomerism.

In presence of a chemistry that is termed *modern*, and which brings into active play the polyatomic bodies, at the same time often forgetting the labours of former authors, M. Frémy reminds us that the first studies on polyatomicity date from the year 1797. Berzelius stated that M. Frémy was the first to introduce new ideas into the science of organic chemistry, which Mr. Graham had developed in his excellent work on phosphoric acid. Since that period the phenomena relating to the polyatomicity of acids have constantly occupied his attention, and he summed up the results of his researches in papers which he has published on metallic acids, hydrates, the gelatinous matters of vegetables, &c. The result is, that M. Frémy affirms that silicic acid can appear in two isomeric states which differ one from the other, not only by their physical properties, but also by their well-defined chemical constitution. They have not the same equivalent, and thus form different salts. The first isomeric state is that which is obtained in decomposing by water the fluoride of silicium. He calls it *metasilicic* acid; its equivalent is $(SiO_3)_3$, it is triatomic, and forms with bases the following three series:—

$$(SiO_3)_3MO,2HO$$
$$(SiO_3)_32MO,HO$$
$$(SiO_3)_33MO$$

This isomeric state is characterised by its solubility in alkaline solutions; it is not destroyed by combination with bases; the metasilicates can be separated, still retaining the same properties. The second isomeric state is that which constitutes quartz; its equivalent is SiO_3; it is insoluble in alkaline liquors, and it forms with bases salts which differ from the metasilicates by their characters and composition. M. Frémy stated, moreover, that he had obtained several of these salts in a crystallised state; they are represented—

$$SiO_3MO,2HO$$
$$SiO_32MO,HO$$
$$SiO_33MO \quad \text{(Peridot)}.$$

The silicic acid is thus triatomic, as the preceding, but it has not the same equivalent.

The principal aim of these researches is, then, to extend to silicic acid the theory that is set forth in former memoirs on the isomerism of acids. M. Frémy wishes to prove that for certain acids the isomeric states are due to different condensations of the molecules, which cause the equivalent of these substances to vary; he has essayed to connect the isomerism of the acid with the change which takes place in the volume of combination. He thinks that these ideas are productive of further research, and that they can explain the very variable constitution of natural silicates.

M. Chasles presented to the Academy, on the part of M. Zeuthen, of Copenhagen, a work originally written in Danish and translated into French, entitled, "*Nouvelle Méthode pour déterminer les Caractéristiques des Systèmes de Coniques.*" The subjects treated upon by M. Zeuthen relate to the theory of multiple contacts and the superior order of conics of a system defined by two characteristics with one or more curves of any order. On these thorny subjects the author has displayed much talent and judgment, without neglecting the rigour necessary in mathematical investigations.

M. Henry Saint-Claire Deville, in his name and that of M. Troost, presented a memoir on the coefficients of dilatation and the constitution of hyponitric acid. This acid presents in the state of vapour a constitution that has been always considered as perfectly normal, provided that its density is taken sufficiently far from its point of ebullition. But this density does not well enough agree with atomic speculation; for, if one would wish to double the formula NO_4, the density of the vapour of the hyponitric acid must be also doubled, which becomes embarrassing. In fact, the hyponitric acid must represent two volumes only, instead of four, admitted hitherto. To meet this difficulty, Messrs. Deville and Troost resolved to measure the coefficient of dilatation of this acid with all precautions in order to ascertain its density. We cannot to-day enter into the details of the process, so we confine ourselves to a rapid enumeration of the results arrived at. The numbers which give the coefficient of dilatation of hyponitric acid give evidence of an unforeseen fact, unknown before, that at a temperature of 40° the coefficient of dilatation attains its maximum value. They show, moreover, that, at about 135° C., the coefficient takes the value of 0·00367 of perfect gases, and does not vary sensibly in the space of 47°. One can even say that it is sensibly constant from 100° upwards, for from 100° to 183° it only varies from 1·68 to 1·57, while from 20° to 100° it varies from 2·65 to 1·68. Thus, the hyponitric acid vapours taken about 135° at a point sufficiently superior to that of ebullition is consistent with the law of Marriotte, and possesses the constant coefficient 0·00357 of the dilatation of perfect gases; the density of the vapour is necessarily 1,589, representing four volumes for the equivalent NO_4. If we wish, as M. Müller says, to double the formula by writing N_2O_8, four volumes of vapour must necessarily be added. Messrs. Deville and Troost refute the opinions of, first, M. Wurtz, that the hyponitric acid NO_4, representing two volumes, is certainly partially decomposed into binoxide of nitrogen and oxygen at the moment when the density amounts to four volumes; second, Messrs. Playfair and Wanklyn, that the densities of the acetic acid and the hyponitric can be doubled.

M. Frémy presented to the Academy, in the name of M. Henri de Parville, his interesting little volume entitled "Causeries Scientifiques," with 47 woodcuts, and published by Savy, a record of the progress of science and industry during the past year. The buildings and arrangements for the new Exhibition are faithfully described. Next come the newest facts relative to the discoveries lately made in astronomy, physics, mechanics, chemistry, medicine and physiology, natural history, and general subjects.

We may here mention another scientific work by Professor Deherain, of the same size (18mo), called the "Annuaire Scientifique," published by Victor Masson and Sons, and containing a valuable history of scientific events during 1866. It is not a *causerie*, but a collection of original articles written by separate and celebrated men, such as Guillemin, author of the excellent work called "Le Ciel;" Dr. Marey, Laureate of the Institute; G. Rayet, of the Paris Observatory; L. Simonin, the distinguished engineer and geologist; Dr. Trelat, &c. The chapter on the exhaustion of our coal-fields is due to M. Simonin, who is also the author of a chapter on the same subject. Both of these little volumes appear to have left nothing unrecorded of our scientific progress at home and abroad.

F. Moigno.

Pharmaceutical Society.—Benevolent Fund.—The dinner in aid of the above Fund will be held at Willis's Rooms, St. James's, next Wednesday, the 20th inst., at half-past six o'clock. The Committee, bearing in mind that the dinner is for a section of the trade only, have not selected a special chairman for the occasion; the President of the Society will therefore preside.

NOTICES OF BOOKS.

Lessons in Elementary Chemistry, Inorganic and Organic. By Henry E. Roscoe, B.A., F.R.S. London: Macmillan and Co. 1867.

Mr. Roscoe has succeeded in producing a volume that is interesting and equal throughout from the commencement to the appendix. The frontispiece is a great improvement upon similar prints in chemical text-books, being a very well executed chromo-lithograph, representing in their proper colours and bands the spectra of the metals of the alkalies and alkaline earths, from the drawings of Bunsen and Kirchhoff. The volume is arranged chiefly for the use of schools and younger students of chemistry at colleges, and we believe that it has been already adopted as the text-book at several of the universities and large public schools.

The contents of the volume possess several novelties, and originality is shown notably in the classification of the metals, although there is, of course, not much room for it in an elementary text-book. The metals are arranged in eleven classes; the rule chiefly followed in this system seems to depend on the sum of the physical properties of the metals, combined with their leading chemical relations, so that the latter are not exclusively used as a basis of classification. This makes all the difference between a natural and artificial system, and the experience of other sciences shows that by the latter a greater number of facts may be so remembered by the student. Some classes have always been recognised as being perfectly natural, but metals that form the connecting links in the intimate chain are not so easily dealt with. A sum of characters, however, seems safely to have been followed in the present case. Thus arsenic, antimony, and bismuth "form a class," because they are triatomic, and form a junction between the metals and *metalloids*, and closely resemble phosphorus in their properties. Other authors have classified together arsenic, antimony, and tin on purely chemical grounds. Now take the silver class, copper, mercury, and silver; the reasons that held for the grouping in the arsenic class do not apply here; on chemical grounds, copper and mercury are widely separated from silver on account of its monequivalency and non-formation of basic salts; but if we take into consideration the other properties of these metals, they are seen to fall naturally into the same class. Lead also forms a class with thallium, its close connexion with mercury being in this manner lost sight of.

This is a good field for graphic illustration, and we comment on it thus at length because we think it is not sufficiently insisted upon as a method of retaining knowledge. Perhaps this, however, may be done more advantageously by the student himself. As a high authority observes, "the student will do well to accept the order and arrangement of his teacher. As, however, minds are variously constituted, he can, if he pleases, try if some other order may not be more applicable—that is to say, he takes the facts he has heard and recorded, and reunites them in a different arrangement and in other words."

The descriptions are clear, with the nomenclature precise, throughout the work, and the amount of information to be obtained from it is shown by the kind of questions appended. Thus we find the following concise account of the oxides of manganese, with a detailed description following:—(1) *Manganous oxide* or *manganese monoxide*, MnO, is a basic body, furnishing the series of well-known manganous salts, in which the oxygen is replaced by its equivalent of another element or of a salt radical—thus $MnO, MnCl_2, MnSO_4, Mn_2NO_3$; (2) *manganic* oxide or *manganese sesquioxide*, Mn_2O_3, which also forms salts, but of a much less stable character, and occurs in nature as the mineral braunite; (3) *red* or *mangano-manganic* oxide, Mn_3O_4, a neutral body, corresponding to the magnetic oxide of iron, and occurring in nature as hausmannite; (4) *black oxide* or *manganese dioxide*, MnO_2, a neutral substance, occurring as the ore of manganese in the minerals pyrolusite and varvacite; (5) and (6) two compounds of manganese and oxygen, which have not been prepared in the anhydrous state, but of which the acids corresponding are known in combination as salts—thus we have K_2MnO_4 potassium manganate, and $KMnO_4$ potassium permanganate."

We may quote, as a type of the questions,

"*Lesson XXXVIII.*

"I. How does starch differ in constitution from glucose?

"II. What weight of dextrine and dextrose can be obtained from 1 kilo. of starch by the action of diastase?

"III. What is the composition of gun-cotton, and what advantages does it offer over gunpowder?

"IV. $C_{20}H_{27}NO_{11} + 2H_2O = C_7H_6O + HCN + 2C_6H_{12}O_6$. Explain the above equation.

"V. What is the composition of ink?

"VI. State some of the general characters of a glucoside."

We could not by our own words point out the merits of the book nearly as well as these extracts do themselves. There are plenty of works in English that can be read after it by the more advanced student; but it has no rival in its own field, and it can scarcely fail to take its place as the text-book at all schools where chemistry is now studied; and the science can now be taught by an ordinary master with little difficulty. We hope that a volume on practical chemistry will be provided also to be used with it, to prevent the science of chemistry being regarded as dry and difficult by those commencing the study of it.

We may add that the book is also well fitted for the junior chemical classes at the universities, colleges, and medical schools. Quite enough organic chemistry for the latter will be found, a third of the volume being devoted to it. A chapter on spectrum analysis, and on the principles of solar and stellar chemistry, is also given. In spite of the care with which the book has been got up, we notice still a few misprints in it—indeed, their non-appearance in any chemical work dealing with organic chemistry is hardly to be expected; and in a new edition, which we hope will soon be called for, these will doubtless be removed.

Hints on Spectacles. By W. Acland, Surgeon. London: Horne and Thornthwaite.

This pamphlet shows what is required to be considered in choosing a pair of spectacles. It has no pretensions to give any fresh information as regards optics or the physiology of the eyes, but will be very useful to those who, finding their eyesight failing somewhat, may wish to know the consequences attendant upon the use of glasses unfitted for them. Mr. Acland has done his work in a very satisfactory manner, and we hope that other opticians also will publish pamphlets, as Messrs. Horne and Thornthwaite have done in this case, to save trouble both to their customers and to themselves.

The matter of the pamphlet is very ably written, and is eminently practical. An account is first given of the anatomy of the eye, as regards its adjustment. Mr. Acland remarks:—"Anatomists, philosophers, and opticians differ as to the means employed by nature to effect such an important object, and although this question has been warmly discussed, each advocating their own pet theory, we are as yet far from the discovery of the cause, and must content ourselves with a knowledge of the result." The diagrams illustrating the different kinds of sight are excellent. The symptoms indicating a necessity for spectacles are so clearly laid down that not even a hypochondriac could mistake them. We agree with Mr. Acland that an optician should possess (1) an intimate

knowledge of the structure of the eye, and of the theory of vision; (2) an extensive acquaintance with the science of optics; (3) a sound mathematical knowledge; (4) a practical acquaintance with the manufacture of lenses and spectacle frames. Mr. Acland shows clearly that he possesses these qualifications, and justly observes—"As a proof that I possess the needful mathematical knowledge, I beg to refer, with some little pride, to a most complete set of formulæ relating to spectacles, now first published and given, and which are, in conjunction with Smee's optometer, used daily by myself with considerable success." A great practical point, as shown here, is to examine the lenses by polarised light to see if they be properly cut from the crystal. The principles of Smee's optometer and Smellen's types are made very clear. The short rules which are given for the preservation of sight and selection of spectacles should be read by everybody, especially persons who are obliged to use their eyes much owing to literary occupations. Thus all should know that irritation of the eyelid can easily be cured by red oxide of mercury ointment; that spectacles should only be used as compensatory agents; that spectacle frames should not be neglected; and that scratching of the lenses should be carefully guarded against. We also learn that single eye-glasses are injurious; that the eye should never view an intense light; a flickering light should be avoided; black objects should only ever be examined by daylight; people with weak sight should avoid the use of gas, and work with a properly constructed reading lamp; and reading during railway travelling should be always avoided. The good reasons for these hints are obvious, but it is as well to repeat them, as there is a great deal of difference between recollecting and remembering a fact. As will be judged from the above extracts, the pamphlet is eminently practical, and we think that few could read it without being convinced that they had learnt something fresh.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Dingler's Polytechnisches Journal. Vol. CLXXXIII. No. 1. January, 1867.

Dr. C. Bischof: "*Analysis of two celebrated Varieties of Fireclay, found near the Banks of the Rhine, and the Estimation of their Refractory Qualities.*"—Theodor Becker "*On the Quantitative Estimation of Potassa by means of Bitartrate of Potassa.*"—Carl Giseke "*On the Estimation of Free Sulphuric Acid met with in Sulphate of Alumina.*"—Dr. P. Bolley "*On the Modes of Analysing Wine.*"

Poggendorff's Annalen der Physik und Chemie. 1866. No. 12.

Dr. H. W. Schroeder van der Kolk: "*On the Theory of Dissociation as exposed by Deville.*"—R. Schneider "*On the Combinations of Selenium with Iodine;*" "*Preliminary Communications on Cyanide of Selenium and Cyanide of Sulphur.*"—R. Hinkener "*On the Separation of Potassium from Sodium and many other Substances by means of Chloride of Platinum.*"

Journal für praktische Chemie. Published by Otto Linné Erdmann. No. 21. 1866.

Dr. L. Elsner "*On the Volatility of certain Substances at White Heat;*" "*On the Behaviour of some Minerals and Varieties of Rock at a very High Temperature.*"—Carrington Bolton "*On the Combinations of Fluorine with Uranium.*"—"*On Erbia and Yttria.*"—R. Hermann "*On Ilmenium and Æschynite.*"—Dr. R. Wagner "*On the Quantitative Estimation of Tannic Acid.*"—Dr. P. Bolley "*On the Pigments of Madder;*" "*On Hypochlorite of Magnesia as a Bleaching Agent.*

Annales de Chimie et de Physique. January, 1867.

H. Geel "*On the Action of the Hydrated Acids, for instance, Hydrobromic Acid, on Ethers.*"—J. Kolb "*On the Manufacture of Soda by Leblanc's Process.*"—Emile Mathieu "*On the Dispersion of Light.*"

Annalen der Chemie und Pharmacie. December, 1866.

W. Heintz "*On the Products of the Dry Destructive Distillation of some of the Salts of Glycolic Acid;*" "*On the Ether of Triglycolamidic Acid, on Trioxethylen Ammonium, and on the Constitution of Urea.*"—W. Luddecke "*On some Combinations of Bismuth.*"—A. Baeyer "*On the Reduction of Aromatic Compounds by means of Pulverised Zinc;*" "*On the Products obtained from Acetone by the Action of Hydrochloric Acid on that Substance;*" "*On the Synthesis of Neurin.*"—L. Carius "*On the Synthesis of Organic Substances;*" "*On Benzenic Acid and Phenose.*" Claus and Von Babo "*On Ozone.*"

Supplement Volume No. 4.—H. Buff "*On the Electrolysis of Alkaline Sulphur Combinations.*"—Marignac "*On the Compounds of Niobium;*" "*On the Compounds of Tantalum.*"—"*On the Action of Hydrogen on Acetylene, while Spongy Platinum is at the same time present.*"

January, 1867.—Dr. J. von Liebig: "*Discourse on the Development of Ideas in the Exact Sciences.*"—Dr. Wilm "*On Itatartaric Acid as Isomeric with Citratartaric Acid.*"—Claus "*On Dibasic Acids.*"—Hesse "*On Physostigmin;*" "*On Pseudomorphine.*"—R. Otto "*On the Action of Chlorine on Sulphobenzide.*"—Tuettschen "*On Titanic Acid.*"—Gautier "*On the Preparation of the Compounds of Chlorine and Cyanogen.*"—Regnault "*On the Specific Heat of Graphite.*"

NOTICES OF PATENTS.

Communicated by Mr. Vavohan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3091. J. Mitchell, Musselburgh, Midlothian, and W. C. Laird, Leith, Midlothian, "A new or improved detergent material applicable to the cleansing of wool and other fibrous substances, and to all purposes where coarse soap is used."—Petition recorded Nov. 24, 1866.

3392. S. F. Schoomnaker, New York, U.S.A., "An improved coating for paper and other materials designed to receive lead-pencil marks which may be repeatedly expunged with moisture."—Dec. 24, 1866.

3433. J. Napier, Salisbury, Wilts, "Improvements in the preparation of food, of a substance to be employed in place of malt, and for the medication of food for animals."—Dec. 29, 1866.

3449. C. F. Flach, Call (Eifel), Prussia, "Improvements in extracting silver from lead."—Dec. 31, 1866.

32. J. Bird, Seymour-street West, Connaught-square, Middlesex, "Improvements in the manufacture of artificial fuel."—Jan. 4, 1867.

39. B. Biggs, Lawrence Pountney Hill, London, "Improvements in and applicable to candles."—Jan. 7, 1867.

54. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the manufacture and refining of sugar." A communication from J. E. Boivin and D. Loiseau, Paris.—Jan. 8, 1867.

82. J. Webster, Birmingham, E. Deane, Arthur Street East, London, and W. Rumble, Sheerness, Kent, "Metallic zinc paint."—Jan. 12, 1867.

88. R. Mushet, Cheltenham, "An improvement in the manufacture of cast steel."—Jan. 14, 1867.

106. A. J. Cooley, Southampton Buildings, Chancery Lane, "Improvements in the manufacture and preparation of dry tinctorial compounds capable of easy solution in water."—Jan. 15, 1867.

CORRESPONDENCE.

Titration of Ethers.

To the Editor of the Chemical News.

Sir,—Your correspondent who writes about "Clairvoyance" was, perhaps, absent when my paper was read before the Chemical Society. I referred to Berthelot's researches at the beginning of my paper on the Titration of Ethers. I am, &c.

J. Alfred Wanklyn.

London Institution, February 12.

Determination of Phosphates in Superphosphate of Lime.

To the Editor of the Chemical News.

Sir,—One of your correspondents alludes to the loss of "soluble phosphates" by keeping in a pile. Is this a real loss of soluble phosphate that in any way deteriorates the manure? We have most of us been taught by agricultural chemists that all the soluble phosphate becomes insoluble within a few hours or days after the superphosphate is mixed with the soil, and that this is owing to the lime contained—in fact, that plants do not suck up the soluble phosphate as such, but that the phosphate of lime is presented to the root fibres in a finely divided state, as a gelatinous precipitate, as can be shown in a test-tube by adding ammonia or potassa to a solution filtered out of superphosphate of lime. Where gypsum is mixed with the superphosphate as a drier, the differences between the determinations of soluble phosphate in recently made samples and those from the same pile after keeping a few months are greater than where none is used. And, so far as my experience goes, the want of agreement between the reports of different chemists has reference to the gypsum used, for a "concentrated" superphosphate has always yielded the same percentage of soluble phosphate, whether under the hands of a "high" or a "low" analyst. I am, &c. Phosphorus.

Condensation of Noxious Vapours from Chemical Works.

To the Editor of the Chemical News.

Sir,—Chemical waste products are, as a rule, so easily fixed that it is a matter of serious complaint when a thing so easily done is not done, causing sickness and the greatest annoyance to every person in the neighbourhood of any chemical manufactory. The fault must be either in defective legislation or in a defective enforcing of powers already given as a protection to the public against annoyance by the chemical manufacturer. You would do me the greatest service by informing me of the exact state of the law on the subject, and also if anything further in this direction is now under discussion. I am living near an artificial manure manufactory, and in the vapours which are copiously evolved from the works, besides quantities of disgusting organic matter, may be found the following gases—SO_3, SO_2, SH_2, and FlH (from the fluor spar in the coprolites), as also, at times, a little HCl and salts. Now, will any of your readers, after looking at the above list, believe that gases capable of doing so much injury to vegetation and the health of all in the neighbourhood, even when in very small quantities, should not be absolutely fixed, and their escape so prevented? The manufacturers could easily do it if they wished, and the optional fixation of noxious gases should not be allowed by the Government.

When in the city of London last, I heard complaints of the effects of acid fumes as being injurious to respiration and clothing in the neighbourhood of one of the most perfectly conducted gold refineries that I have yet met with. If, then, dwellers in the city of London grumble in vain under such circumstances, what progress towards condensation of noxious vapours will chemical manufacturers make if every possible preventive means be not enforced?

I am, &c. Sufferer.

February 11.

MISCELLANEOUS.

Precautions against Cattle Plague in Holland.—As an instance of the very rigorous measures of precaution to prevent the cattle plague now raging in Holland from being carried over into Prussian territory, the following may serve:—Two lads, living in the Prussian portion of the village of Lobith (a portion of it is on Dutch territory), go to school at Elten, a village on Dutch territory about two miles from their residence; the greater part of their road is on Netherlands territory. On returning from school at night, these boys are subjected for fully one hour to a severe disinfecting process. The lads, annoyed at this, tried the other day to elude the vigilance of the Prussians by taking their way through fields. No sooner, however, had they entered upon Prussian territory than the soldiers on duty commenced firing their needle guns at them, and forced them to return and undergo the disinfecting process. You must know that, besides armed Custom-house soldiers, Prussia now keeps on the Netherlands frontier a strong military force to prevent parties getting across without quarantine, &c.—*Indépendance Belge*, February 9.

Fouling of Guns.—The following novel theory of fouling, which recently appeared in the *Engineer*, will amuse, if it does not interest, our readers:—"All who have been accustomed to take a routine view of the results of gunpowder explosion, assuming them to be simply made up of sulphur, potassium, carbonic acid, and nitrogen, will be astonished to discover that the preponderance of solid residue is not sulphide of potassium, but a mixture of carbonate and hydrate of potash. Any chemist will at once comprehend the importance of these materials in respect to the prevention of fouling, but to others not chemists the fact should be indicated that carbonate of potash is no other than pearlash, a saponifying agent when it comes into contact with grease or oil, and that hydrate of potash is a saponifying agent to a still higher degree. The small-arm rifleman, to whom the troubles of fouling are so familiar, will not be slow to comprehend the bearing of this fact. Given a competent supply of saponifying material, then, if the powder be good, the necessary materials will be supplied for the production of soap, through the operation of which the fouling will be reduced to practically inefficient limits."

Sanitary Laws.—The Council of the National Association for the Promotion of Social Science has lately paid considerable attention to the subject of the working of the public health laws. Every one who has come in contact with the gentlemen to whom their execution is entrusted, must have been astonished at the amount of good work that is done by them in spite of the many difficulties in their way, and have thought that the laws relating to such subjects must require great improvements for them to be more easily enforced. In fact, all sanitary officers find, more or less, that their power is very much cramped, unless some pestilence breaks out to frighten householders into attending to matters that at other times they do not feel any interest about. In the proposed memorial

drawn up by the Council, the more prominent of the evils of the system as a whole are shown to be as follows:—First, of general and local enactments, many of the latter are altogether out of place, and require transference to the former. By one section of one bill the penalty for selling diseased meat is 10*l.*, while for precisely the same offence, by a section of another bill, the fine is 20*l.* The memorialists, in the most moderate language, observe, "This of necessity leads to confusion." Again, many important enactments are permissive. The memorialists justly insist that "*the most useful* measures" should be peremptory. That may be all very well, but the simple expression of "a permissive nuisance" seems very illogical. All without exception should be on one footing, unless the law will consent to define a great nuisance as opposed to a little one. Nuisances should certainly be defined by law, and of course suppressed. If it be left to the opinion of the local authority to say whether this or that nuisance should be suppressed, the whole spirit of sanitary improvement is lost. Lastly, for sanitary reform, we want one "head centre" or head court which might compel the local authorities to do their duty. Thus the questions arising would not require reference to this or that court; and the provisions of one Bill (the Sanitary Act of 1866) would not then have to be carried out in one case by local authorities, in another by sewer inspectors, in a third by the police magistrates and justices, or, as in the case of the appointment of county analysts, by the Court of Quarter Sessions of every county. We think that the memorialists have shown sufficient sources of weakness in these laws to render any efficient administration of them next to impossible, and are sure that the following is a very moderate statement indeed; the literal truth would be much more severe:—"The local authorities are more or less *unlearned*, and for that reason require plain and specific directions. They are interested in diminishing the rates, and are, therefore, frequently unwilling to act in sanitary matters except under compulsion. They are often ignorant of the importance of sanitary precautions, and indifferent to the most flagrant nuisances."

Science and Public School Education.—At the Royal Institution, on Friday, February 8, the Rev. W. Farrar, M.A., a high authority on the subject, gave a most eloquent address "On Public School Education." Mr. Farrar's evidence on the subject is of great value, since the rev. gentleman has himself been trained, and has trained others, in the existing system. It was urged that the present system was not only passively, but actively, bad in its training influences on the mind, that England was the only civilised country where such a state of things was tolerated, and the comparison between the activity of science and lethargy of theology was fairly made. The lecturer did not go so far as to urge the abandonment altogether of the classics, but was strongly in favour of its giving way in part to science. He said truly that the clergyman of the present day could not venture to talk of the most elementary scientific facts to the ordinary artisan or workman, and that, in the self-sufficiency of his knowledge, "the young B.A. fresh from college found it easy to crush Darwin with a text." The lecturer, in conclusion, most eloquently named some of the great triumphs of physical and natural science, and denied indignantly that it encouraged a spirit of scepticism, remarking that, in this enlightened age, no religion could hold its own without a full study of science by its professors. It is a strange fact that the most forcible denouncers, past and present, of an exclusively classical education are, or have been, those who have had the largest experience of its working.

Editorial Courtesies.—Recently, commenting on an assertion that the iron trade was leaving us, the *Examiner* quoted, against such a belief, a statement of facts as from the *Mining Journal*. Thereupon the *Birmingham Daily Post* remarked:—"The quotation here given as from the *Mining Journal* was taken by that paper from our own leading columns, word for word, without acknowledgment." On which, down comes the *Iron Trade Circular* with, "The editor of the *Birmingham Daily Post* has omitted to mention that he took his facts and figures from us, and we may as well say that ours were supplied to us by the *Economist*."

Castor oil is as useful in the trades as it is as a medicine. It is much better to soften and to redeem old leather than any other oil known. When boots and shoes are greased with it, the oil will not at all interfere with the polishing afterwards, as is the case with lard, olive, or any other oil. In Harrisburg, Pennsylvania, the old leather hose of some of the fire companies was greased with it, and it was found to become almost as soft and flexible as new leather. Leather belts for transmitting motion in machinery will usually last three to five years, according to the wear and tear they are exposed to; when greased with castor oil, they will last ten or more, as they always remain flexible and do not crack. Besides this advantage, castor oil will prevent slipping, so that a belt three inches wide impregnated with it will be equal to a belt four and a half inches wide without castor oil. It is necessary, however, to wait twenty-four hours, till the oil has disappeared from the surface and penetrated the leather; otherwise the freshly-greased surface will cause slipping. That rats and other vermin detest anything impregnated with castor oil, and will not touch it, is another advantage.

Meetings for the Week.

Monday, February 18.

Medical Society, 8 p.m.

Tuesday, February 19.

Royal Institution, 3 p.m. Professor Tyndall, "*On Vibratory Motion, with special reference to Sound.*"

Pathological Society, 8 p.m.

Ethnological Society, 8 p.m.

Wednesday, February 20.

Society of Arts, 8 p.m.

Geological Society, 8 p.m.

Thursday, February 21.

Royal Society, 8½ p.m.

Royal Institution, 3 p.m. Professor Tyndall, "*On Vibratory Motion, with special reference to Sound.*"

Chemical Society, 8 p.m.

Friday, February 22.

Royal Institution, at 8 p.m. M. D. Conway, Esq., "*On New England.*"

Saturday, February 23.

Royal Institution, at 3 p.m. G. A. Macfarren, Esq., "*On Harmony.*"

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

F. L. O. P.—Thanks for your communication. It is, however, unsuitable for our columns.

J. W. S.—The articles will be resumed almost directly.

W. M B.—We do not advise the publication of your results in their present imperfect state. The process you describe could scarcely yield an acid sufficiently pure to analyse.

R. J. Tinniswood.—100 grains of pure dry carbonate of soda = 58·5 of oxide of sodium. This result is yielded whether the calculation is made with the formulæ and equivalents given in Fownes, according to the old notation, or whether the newest theory is adopted as given in Dr. Frankland's book. The result of 59·25 = oxide of sodium is therefore an error.

J. Stephens.—Arago's polarisation photometer is considered one of the best. It is much more complicated and troublesome than Bunsen's or Ritchie's, but we consider it gives more accurate results.

Books Received.—The Modern Practice of Photography, by R. W. Thomas, F.C.S.; Analysis, Purification, &c., of Coal Gas, by Rev. W. R. Bowditch, M.A., F.C.S.

Received.—Dr. Letheby; B. J. G.; R. C. C. L.; Child.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Methods employed to make sure of the Purity of Silver, by J. S. Stas.

In my "*Researches upon the Reciprocal Relations of the Atomic Weights*," I have stated that *pure silver may be fused and kept fused in air at a temperature sufficiently high to volatilise it without becoming at all stained or discoloured, and without giving off discoloured vapour.* I have taken this fact as a basis while seeking to ascertain the purity of the silver prepared by reduction from the chloride by means of potash and sugar of milk, or by reduction of *ammoniacal nitrate of silver* by means of sulphite of ammonium and ammoniacal cuprous sulphite. For this object about 400 grammes of silver from the chloride, placed in a crucible of lime from white marble, itself enclosed in a refractory crucible, were submitted to the *hissing* flame produced by the combustion of ordinary lighting gas in pure oxygen. *The silver fused without becoming in the least discoloured.* I then heated it until it boiled *violently*. The silver first gave to the flame the sodium character; but in a short time the yellow colour disappeared, and, so long as the silver did not boil, no discoloration appeared, although the metal gave off vapour in considerable quantity. After the silver boiled a *pale blue vapour* was produced,* which occasionally bordered upon purple.†

This vapour stained the lime a deep yellow, which colour, however, disappeared on the application of heat. When, by this species of refining, the silver must have lost all volatile matter, and when the fixed but oxidisable materials that it might contain must have united with the lime, I poured it from a good height, and in a thin stream, into distilled water, where it took the form of almost spherical globules of a pure white. The crucible presented no trace whatever of a metallic oxide or silicate.

The same treatment was applied to the pulverulent silver prepared by the cuprous ammoniacal sulphite, and identical phenomena presented themselves, excepting always the intense yellow colour of the flame, which was produced when the silver reduced from the chloride was heated to near its boiling point.

Before submitting the silver that I wished to test to the action of the oxyhydrogen gas-flame I took care first to expose the crucible of marble lime to the heat of the same oxyhydrogen gas, so as to eliminate as much as possible from the lime the volatile substances that give a particular colour to the flame. I observed on this occasion that all marbles contain notably *sodium*; that many contain *strontium* and *lithium*. By means of the method I am about to mention, I proceeded to the comparison of the refined silver with that from which it was derived, and with the typical silver prepared by the electrolysis of cyanide of silver and ammonium. Having been struck by the facility with which silver may be boiled violently, and distilled in the flame of *oxyhydrogen gas*, which MM. Henri Sainte-Claire Deville and De Bray‡ had before remarked, I wished to make use of it for the double purpose of procuring distilled silver, and at the same time to ascertain if silver refined as I have just shown still retains any traces of fixed bodies capable of uniting with lime.

For this purpose I had made in a block of lime, prepared from *white marble*, of from twenty-five to thirty centimetres in length, by ten centimetres width and height, a circular cavity three centimetres in diameter and two centimetres in depth, in communication with an inclined plane also three centimetres in width, by at most half a centimetre in depth, and serving to conde ise the vapour of silver. This inclined plane was terminated by a reservoir acting as a receiver for the liquid metal.

I placed about 50 grammes of refined silver in the cavity, first heated to whiteness by the application of a jet of lighted gas burning in a suitable excess of compressed air, and I covered the block with a plate of lime from white marble, five centimetres in thickness, pierced with two inclined circular openings, one corresponding to the circular cavity, the other to the little reservoir at the end of the inclined plane. Through one of the openings of the plate I passed one of the oxyhydrogen blowpipes of MM. Henri Sainte-Claire Deville and De Bray. This blowpipe had *very thick ends* of platinum to avoid their fusion, and the transportation of the metal. When the interior of the cavity had been heated to the boiling point of silver, not more than ten or fifteen minutes were required to distil the whole of the silver. *The 50 grammes were volatilised without leaving in the cavity of lime, which was used as the retort for distillation, the slightest appreciable residue to the eye assisted by a glass.*

I poured into distilled water the silver that I thus succeeded in obtaining in the receiver. The distillation of silver is such an easy operation to manage that I performed it three times. Nothing could be easier than to procure a kilogramme of silver, if the apparatus was proportioned to the mass. I must, however, admit that, in the operations I have described, *at least* half the silver used was lost. In fact it was carried away in the state of pale blue vapour by the current of oxyhydrogen gas, although this was very moderate, and without too great an excess of oxygen; it was diffused through the surrounding atmosphere, the transparency of which it affected, while imparting to it a very sensible metallic taste. My apparatus was also very imperfect; vapour of silver escaped in quantities by the opening intended to carry off the products of combustion, and all round between the block and the thick plate serving as a cover to it. Their surfaces, indeed, were not sufficiently well planed to fit very exactly.

Everywhere that the vapour of silver passed it left a light or dark yellow stain, like that left by the vapour of litharge.

The inclined plane, also, intended for the liquefaction of the silver vapour, was neither suitable in its form nor its dimensions to condense the whole of the metallic vapour carried off by the more or less compressed current of oxyhydrogen gas.

This detail is insignificant, since it resolves itself into a question of expense, which may be neglected in researches of this nature; but if a chemist should one day wish to renew with silver the series of determinations of the atomic weights, *it is to the volatilisation of the previously refined metal that I should advise him to have recourse to procure absolutely pure silver.*

Before concluding I must add that I noticed that the condensation of the vapour of silver takes place the more readily the less excess of oxygen the oxyhydrogen gas contains.

* Some chemists assign a *green colour* to the vapour of silver. The green colour observed arose indisputably from the copper contained in the silver submitted to the experiment.

† I attribute the purple colour to the existence of strontium or lithium in the marble used for the preparation of the quicklime crucible.

‡ *Annales de Chimie et de Physique*, vol. lvi. p. 413.

Contribution to our Knowledge of Osmium, by F. Wöhler, *Professor of Chemistry in the University of Göttingen.**

It seems to be universally admitted that in the substance obtained by melting osmium with caustic potash, the osmium is contained as osmic acid, OsO_4. This is not correct; for whilst, by the addition of acids, no precipitate takes place in a yellow aqueous solution of osmic acid in potash, but the latter changes colour; in the solution of the fused compound (whether nitrate or chlorate of potassium is used for oxidation), acids cause a strong black precipitate, with simultaneous formation of osmic acid. The compound produced by fusing contains, therefore, plainly a lower oxide, which, on being separated from the potash, falls as osmic acid and a black oxide. It cannot be osmious acid, OsO_3, discovered by Fremy, for the solution of the potash salt of the latter is violet, while the solution of the fused compound is a deep and clear yellow. By fusing ruthenium with caustic potash, without nitrate or chlorate of potassium, we obtain a dark brown mass which entirely dissolves in water with a deep orange-yellow colour. On the addition of nitric acid, as is well known, a black oxide falls, while the solution acquires a smell of ozone, apparently from ruthenic acid, RuO_4.

This similar behaviour of osmium and ruthenium is noteworthy, because it shows that if the two metals, as is usual, occur together, they cannot be separated in this way.

The subject deserves a still closer investigation. That which Claus says on the subject is not clear and decisive. He says,† "If a piece of caustic potash is dissolved in a solution of osmic acid (OsO_4), there results a blood-red solution, and KO,OsO_3 is formed quickly with evolution of oxygen. With great excess of potash there might be formed a superoxide of potassium, which gives off oxygen very slowly and almost imperceptibly. This red fluid still smells for a long time of osmic acid, until at length it loses the smell and changes its burning taste into a sweet compound of the salt KO,OsO_3; then the whole is changed into this salt without any reducing agent."

But then the solution must have become violet, which does not take place. I have never been able to perceive any evolution of oxygen. If we take caustic potash, we indeed see a feeble evolution of gas; but the fused hydrate of potash dissolves in water with a feeble evolution of gas. It would seem more probable that peroxide of hydrogen was formed, but I have not been able to perceive any.

I have also observed the following:—Sublimed osmic acid in excess was dissolved in solution of potash, and the deep reddish-yellow solution was allowed to evaporate spontaneously over hydrate of potash. There were formed wart-like opaque masses of crystals which were soluble in very little water with a reddish-yellow colour without leaving the least trace of the difficultly soluble violet osmite of potash. From this concentrated solution nitric acid precipitated white osmic acid, which, however, soon became grey, with a simultaneous precipitation of black oxide, whose amount gradually increased.

Metallic osmium was fused at a bright red heat with hydrate of potash. The black mass dissolved freely in water with a deep reddish-yellow colour. The solution by distillation in a retort was concentrated to one-fourth, whereby only very little osmic acid went over, and was allowed to remain closed up. In a short time a number of small octahedra of violet osmite of potash were deposited. A stream of pure carbonic acid gas was passed through the decanted yellow solution. It became first colourless, and then violet, with separation of a greyish-violet deposit and liberation of osmic acid. The deposit dissolved with a violet colour in much water, and left behind a little black oxide. From this solution a black oxide was precipitated by nitric acid, with formation of osmic acid. Carbonic acid acts in a similar manner upon the solution of the violet crystals.

If the black oxide is treated with concentrated hydrochloric acid, there results first a purple solution; it then becomes yellowish-brown, and lastly green. By heating it becomes brownish-yellow. With sulphuric acid it becomes a clear yellow, and also by boiling, but nothing is reduced. Zinc, however, precipitates the metal in black flakes.

* Communicated by the author.

† *Journal für praktische Chemie*, vol. xc. p. 91.

On Boronatrocalcite, by Georg Lunge, *Ph.D.**

That interesting mineral which bears the names of boronatrocalcite, tiza, hydroboracite, tincalcite, rhodizite, and a great many others besides, but which is, perhaps, best known in this country by the somewhat unscientific name of borate of lime, has been the subject of investigations and analyses by a great number of chemists. Unfortunately, it never occurs in the pure state, but always mechanically mixed with, and often perfectly penetrated by, chloride of sodium, sulphates of sodium and calcium, etc. Besides, water has a decomposing action on this mineral.

It cannot be a matter of surprise, then, that no two analyses of it agree with one another—as will be seen from the very complete synopsis in Richardson and Watts' "Chemical Technology," vol. i. part iv. p. 209—and that also the ideas of different chemists about the real chemical formula of pure boronatrocalcite are very much at variance. Some declared it to be a borate of calcium containing sodium salts merely as a mechanical impurity; others took it for an accidental mixture of the borates of sodium and calcium; but more judicious inquirers found it to be a double salt of borate of calcium and borate of sodium. Especially the well-known chemist, Dr. Kraut, proved from many of the former analyses, and from his own, that by taking into account the never failing admixtures, and duly allowing for them in the calculation, the composition of boronatrocalcite can be reduced in those cases to the formula—

$$NaO,2BO_3 + 2CaO,3BO_3 + 15HO.$$‡

It is also a merit of Kraut's to have pointed out the unreliability of some of the former analyses—for instance, of Helbig's.§ Those chemists, of course, who did not find any sodium whatever, like Reichardt,‖ need not be taken into account at all. A simple glance at his figures, especially at the enormous percentage of boracic acid, is quite sufficient to settle that question. Rammelsberg¶ gives the formula

$$NaO,2CaO,6BO_3 + 18HO;$$

but it cannot be denied that the percentage of boracic acid in his own analysis falls too much short of that required by his formula, and agrees better with Kraut's. The only analysis, indeed, which decidedly gives

* Communicated by the author.

† *Archiv der Pharmacie*, 162, 25.

‡ I am using the old notation, both because Kraut is doing so, and because it is not yet very generally applied to mineralogical formulæ.

§ Liebig und Kopp, *Jahresber.* 1858, 737.

‖ *Eodem loco.*

¶ Liebig und Kopp, *Jahresber.* 1856, 884.

$2BO_3$ to the bases, is that of Helbig, and this cannot at all be relied upon, according to Kraut's showing, as mentioned just now.

I expected, accordingly, when I obtained some time ago a large quantity of boronatrocalcite for technical purposes, to find its composition agreeing with Kraut's formula, if I selected a very pure specimen and eventually allowed for the admixture of chlorides and sulphates. I found, in the first instance, that by taking only the central parts of the well-known nodules in which the mineral appears, I was able to prepare a sample perfectly free from chlorides and sulphates, and showing also no traces of sand, phosphoric acid, carbonic acid, aluminium, iron, or manganese; only boracic acid, sodium, calcium, and a very small quantity of magnesium. The latter apparently substitutes its equivalent of lime, as there is no other acid it could be combined with but boracic. I was, therefore, fortunate enough to be independent of all allowances for impurities, which may very easily lead into erroneous or disputable computations. In the second instance, I found my sample to be undoubtedly a biborate, while in Kraut's formula the ratio between the bases and boracic acid is 3 : 5. This occasioned me to analyse my sample, with the accuracy required for scientific results, in the following way:—

The mineral was digested for some time, according to Rose's prescription, with hydrofluoric acid in a platinum crucible; then pure sulphuric acid was added, and the mass was evaporated to dryness and ignited. Having cooled down, it was dissolved in hot water, acidulated with hydrochloric acid; the liquid was neutralised with ammonia, just acidulated with one drop of acetic acid, and the calcium precipitated by oxalate of ammonium. From the filtrate the magnesium was precipitated by phosphate of sodium. This mode of operating, in which the boracic acid is removed as fluoride of boron, appears unnecessarily troublesome, and was only followed to control my own simpler method—viz., simply to dissolve the mineral in dilute hydrochloric or nitric acid at a gentle heat, and to precipitate the calcium as oxalate from the solution containing all the boracic acid. The two estimations were entirely coinciding within the ordinary limits, and the expulsion of the boron appears, therefore, quite unnecessary.

The sodium is easily estimated by dissolving the mineral in a measured quantity of standard test acid (preferably hydrochloric or nitric acid) and remeasuring the excess of acid by a standard solution of alkali. The transition from the bright red colour of litmus caused by the strong acid into the purple caused by boracic acid, is perfectly sudden and accurately determinable. In this way is found the saturating capacity of all the bases combined with boracic acid; by deducting from this figure that corresponding to the calcium and magnesium previously estimated, there will be obtained a residue, which is to be calculated for sodium. The only objection to this method could be that the presence of potassium would make it inaccurate; but no trace of potassium could be found in my sample. Lastly, the quantity of water must be ascertained by igniting the mineral, and it can then be safely computed that all the rest not accounted for as water and as the oxides of sodium, calcium, and magnesium, is boracic acid. Of course, this is not allowable unless at least two analyses agree with each other, and unless a search for all other elements likely to interfere has been made; but if these conditions have been complied with, the computation of the residue for boracic acid is perfectly justified. A direct estimation would certainly be preferable; but a satisfactory direct method of determining boracic acid is still a desideratum of analytical chemistry.

My results were—Water, 36·89, 36·80, mean 36·85 per cent.; lime, 12·60 (estimated after the expulsion of boron), 12·78 (estimated directly from the acid solution), mean 12·69 per cent.; magnesia, 0·50 per cent.; saturating capacity of 1 gramme, 6·62, 6·54, mean 6·58 cubic centimetres of standard nitric acid. By deducting therefrom 4·53 (for 12·69 CaO) and 0·25 (for 0·50 MgO), there remains a residue of 1·80, corresponding to 5·58 NaO. On adding the mean percentages of water, soda, lime, and magnesia, the figure 55·62 is obtained, leaving 44·38 per cent. for boracic acid.

It is evident that the bases are combined with $2BO_3$, for then

12·69	Lime require	31·54	boracic acid.
0·50	Magnesia ,,	0·87	,,
5·58	Soda ,,	12·53	,,
		44·94	

a figure very nearly coinciding with that found above. The whole composition of the mineral agrees almost completely with the formula—

$$2(NaO,2BO_3) + 5(CaO,2BO_3) + 42\ aq.,$$

only with the substitution of magnesium for a small quantity of calcium.

In the following table a compound equivalent for lime and magnesia has been introduced, computed from the ratio of Ca : Mg = 18 : 1—

	Equivalents.	Calculated.	Found by analysis.	Required by Kraut's formula.
2NaO .	62·	5·82	5·58	7·83
5 { CaO, MgO }	138·	12·95	13·19	14·14
$14BO_3$.	487·2	45·74	44·38	43·94
42HO .	378·	35·49	36·85	34·09
	1065·2	100·00	100·00	100·00

It is obvious that Kraut's formula cannot be applied to my sample, and that my own formula agrees with the results of the analysis within reasonable limits. The deciding point is the saturating capacity of the bases; Kraut's formula requires 7·58 cubic centimetres standard acid for 1 gramme, my formula 6·51; and I found, as mentioned above, 6·62, 6·54, mean 6·58. It is perhaps worthy of remark that all formulæ, Rammelsberg's, Kraut's, and my own, give three equivalents of HO to each equivalent of BO_3.

I may be permitted to state that I published the analytical results detailed here in the *Annalen für Chemie und Pharmacie*, of April last year.** In consequence Dr. Kraut wrote to me to ask for a sample of my material. Between this request and my analysis six months had elapsed, and my stock of boronatrocalcite had been used up for technical purposes, except a few ounces, out of which I sent a sample to Dr. Kraut. Of course, this could not be so well isolated from the admixtures as my former one had been, and, indeed, Dr. Kraut found in it†† 6·72 per cent. of chloride of sodium and 4·74 sulphate of sodium. However, starting from the saturating capacity of the sample, which he found equal to 23·27 SO_3 (= 5·82 cubic centimetres standard acid), he assumed it to contain 88·54 per cent. boronatrocalcite, according to my formula; and his estimation of lime agrees exactly with this assumption, for he found, as a mean of three estimations, 11·57 CaO instead of 11·51, as required by 88·54 per cent. mineral

* Vol. 138, p. 51.
†† *Annalen der Chemie und Pharmacie*, 139, 52.

of my formula, by computing the small quantity of magnesium as its equivalent of calcium. His analysis is therefore a complete affirmation of mine in all its essential parts, and proves my formula to be correct. This case is, then, the first one, established beyond doubt, in which a specimen of boronatrocalcite showed $2BO_3$ to each equivalent of calcium and sodium. Would the surmise be quite unjustified, that my specimen represents the mineral in its original state, not having yet experienced any loss of boracic acid by extraneous causes?

TECHNICAL CHEMISTRY.

The Manufacture of Salt.

Our attention has been called to the following extract from a work entitled, "The Resources, Products, and Industrial History of Birmingham and the Midland Hardware District," 1866. Mr. Samuel Timmins is editor, but the name of the author of the chapter on salt is not given.

When factory and other operatives receive so much legislative attention, it is only fair to remember these neglected saltmakers of Worcestershire.

Solution and crystallisation are so interesting to chemists that we think it probable that mention of this subject in the Chemical News will bring a large amount of attention.

"The social condition of the saltworkers has for centuries been, and in most cases continues to be, a reproach to English civilisation. The heat of the stoves and pan houses in which they work, and which frequently better deserve the name of their homes than the miserable hovels in which they huddle out of working hours, renders more than a minimum of clothing unnecessary, if not burdensome, and even this minimum is not unfrequently dispensed with by both sexes. The work is necessarily continuous day and night, and from Monday morning to Saturday evening it often happens that the labourer never quits the precincts of the works, snatching his intervals of rest beside the pans. Men and women, boys and girls, are thus exposed to more than all the debasing and demoralising influences which haunt the worst dwellings of our agricultural labourers, without a single antagonistic agency to prevent their lapse into the lowest depths of brutish immorality. The social condition of the saltworkers has consequently been, and probably still is, more abjectly degraded than that of any other class equally numerous, although their poverty is by no means so depressing. With scarcely an exception, wherever salt manufactures on a large scale have existed, the population employed in them has been the disgrace and pollution of the neighbourhood, a community almost unapproachable by philanthropy and irreclaimable by religion. Happily we are able to record the dawn of better days in the district nearest to Birmingham.

"It is now eight years since the employment of women at the Stoke Works was entirely discontinued by the proprietor, John Corbett, Esq., and although the full result of the measure will not be felt until a new generation has arisen, it has already acted on the habits and condition of the workpeople in such a manner as to produce a social revolution in the neighbourhood. Marriage, an institution previously almost ignored, has, in a great measure, superseded the indiscriminate concubinage resulting from the former conditions of labour; the dwellings of the workpeople, now continuously occupied, have very perceptibly improved; and if the condition of the saltworker, from a social and moral point of view, is still greatly lower than that of the average artisan, it is far higher than it ever has been, or, indeed, could be, under the old system. The reformation thus effected has also been materially aided by an alteration in the arrangement of the work introduced about five years ago. Formerly, one man only was usually appointed to take charge of each pan both by day and night, and was paid at the rate of 1s. 10½d. per ton of salt manufactured. In place of this system, what is termed 'shift work' is now universally adopted at the Stoke Works. Two men, one for the day and one for the night, are appointed to each pan, and receive 2s. per ton proportionally divided between them, the higher rate of payment being compensated by the additional amount manufactured under the new system. Three assistants are required to each pan, who are paid by the men in charge of it out of their receipts for the salt manufactured. Much of the work can be done by boys and girls, and a father, by taking his children as his assistants, could make a considerable addition to his wages. A strong inducement is thus held out to parents to employ their children in such a manner as wholly to preclude their chance of obtaining any education, although at Stoke the inducement no longer exists in the case of girls. All the work is paid by the piece, and even in processes apparently so simple an amount of judgment, experience, tact, and dexterity is required which makes a wide difference between the wages of a good and a bad workman. A fair workman, on an average, at 2s. per ton, can, it is calculated, make about 28s. per week. Each head of a pan is paid 22s. weekly on account, and the balance is settled monthly, the work being appraised by the foreman of the salt works, who rejects or reduces the allowance for work in any way faulty or imperfect. About 500 hands are employed at Stoke Works, and the average amount of salt of all kinds manufactured is about 3000 tons per week, with a consumption of from 1500 to 2000 tons of fuel.

"Previous to 1823, when the duty on salt, then as high as 15s. per bushel, was repealed, the entire annual produce of Droitwich did not amount to more than 9000 tons, the entire produce of Worcestershire being now about 200,000 tons per annum. The Cheshire salt works are capable of producing 1,000,000 tons per annum, but the supply being immensely in excess of the demand, many works are always standing still, both in the Cheshire and Worcestershire districts. The export trade of Worcestershire is about 50,000 tons annually; that of Cheshire about 650,000 tons.

"The price of salt for many years has ranged within very narrow limits. Monthly meetings are held by the manufacturers, as in other trades, and arrangements are made as to the rate of wages, the prices to be charged, and other matters affecting their common interests. The number of 'small masters' in the trade, however, renders any effective combination among the manufacturers as difficult as the introduction of any substantial reform in the habits and condition of the workpeople. A large portion of the trade in the aggregate at Droitwich is in the hands of such masters, who, not possessed of sufficient capital to undertake the manufacture on a scale large enough to permit the adoption of expensive improvements in machinery, or in the system of working and payment of wages, are still able, by employing their own family as workpeople, to produce salt at a rate so low as to render it difficult for those able to initiate the necessary reforms to realise an adequate remuneration from them. On the whole, there-

fore, although the experiment tried at Stoke has, we believe, been commercially as well as socially successful, and must in the long run materially affect the condition of the saltworkers, there is but little immediate prospect of their making any great general advance in the social scale. For the present the public is able to purchase salt at a price possibly lower by some infinitesimal fraction than it would be if the manufacture were entirely in the hands of large proprietors and the employment of women and children strictly prohibited; but the advantage is dearly purchased by the continued existence amongst us of a class of labourers which ranks below that even of the working colliers."

PHYSICAL SCIENCE.

On the Augmentation of the Power of a Magnet by the Reaction thereon of Currents induced by the Magnet itself, by* Charles Wheatstone, *F.R.S.*

The magneto-electric machines which have been hitherto described, are actuated either by a permanent magnet, or by an electro-magnet deriving its power from a rheomotor placed in the circuit of its coil. In the present note I intend to show that an electro-magnet, if it possess at the commencement the slightest polarity, may become a powerful magnet by the gradually augmenting currents which itself originates.

The following is a description of the form and dimensions of the electro-magnet I have employed. The construction, it will be seen, is the same as that of the electro-magnetic part of Mr. Wilde's machine.

The core of the electro-magnet is formed of a plate of soft iron, 15 inches in length and $\frac{1}{2}$ inch in breadth, bent at the middle of its length into a horseshoe form. Round it is coiled, in the direction of its breadth, 640 feet of insulated copper wire $\frac{1}{12}$ inch in diameter. The armature, which is according to Siemens' ingenious construction, consists of a rotating cylinder of soft iron, $8\frac{1}{2}$ inches in length, grooved at two opposite sides, so as to allow the wire to be coiled upon it longitudinally; the length of the wire thus coiled is 80 feet, and its diameter is the same as that of the electro-magnet coil.

When this electro-magnet is excited by any rheomotor, the current from which is in a constant direction, during the rotation of the armature currents are generated in its coil during each semi-revolution, which are alternately in opposite directions; these alternate currents may be transmitted unchanged to another part of the circuit, or, by means of a rheotrope, be converted to the same direction.

If now, while the circuit of the armature remains completed, the rheomotor be removed from the electro-magnet, on causing the armature to revolve, however rapidly, it will be found, by the interposition of a galvanometer or any other test, that but very slight effects take place. Though these effects become stronger in proportion to the residual magnetism left in the electro-magnet from the previous action of a current, they never attain any considerable amount.

But if the wires of the two circuits be so joined as to form a single circuit in which the currents generated by the armature, after being changed to the same direction, act so as to increase the existing polarity of the electro-magnet, very different results will be obtained. The force required to move the machine will be far greater, showing a great increase of magnetic power in the horseshoe; and the existence of an energetic current in the wire is shown by its action on a galvanometer, by its heating 4 inches of platina wire ·0067 inch diameter, by its making a powerful electro-magnet, by its decomposing water, and by other tests.

The explanation of these effects is as follows:—The electro-magnet always retains a slight residual magnetism, and is therefore in the condition of a weak permanent magnet. The motion of the armature occasions feeble currents in alternate directions in the coils thereof, which, after being reduced to the same direction, pass into the coil of the electro-magnet in such manner as to increase the magnetism of the iron core; the magnet, having thus received an accession of strength, produces in its turn more energetic currents in the coil of the armature, and these alternate actions continue until a maximum is obtained, depending on the rapidity of the motion and the capacity of the electro-magnet.

If the two coils be connected in such manner, that the rectified current from the coil of the armature, passes into the coil of the electro-magnet, in the direction which would impart a contrary magnetism to the iron core, no current is produced, and consequently there is no augmentation of magnetism.

It is easy to prove that the residual magnetism of the electro-magnet is the determining cause of these powerful effects. For this purpose it is sufficient to pass a current from a voltaic battery, a magneto-electric machine, or any other rheomotor, into the coil of the electro-magnet in either direction, and it will invariably be found that the direction of the current, however powerful it may eventually become, is in accordance with the polarity of the magnetism impressed on the iron core.

If, instead of the currents in the coil of the rotating armature being reduced to the same uniform direction, they retain their alternations, no effects (or, at most, very small differential ones) are produced, as no accumulation of magnetism then takes place.

I will now call attention to the fact that stronger effects are produced at the first moment of completing the combined circuit than afterwards. The machine having been put in motion, at the first moment of completing the circuit four inches of platina wire were made redhot, but immediately afterwards the glow disappeared, and only about one inch of the wire could be permanently kept at a red heat. This diminution of effect was accompanied by a great increase of the resistance of the machine. The cause of the momentary strong effect was that the machine, from its acquired momentum, continued its motion for a few seconds, though it required a stronger force than could be applied to maintain that motion. Each time the circuit is broken and recompleted, the same effect recurs.

On bringing the primary coil of an inductorium (Ruhmkorff's coil) into the circuit formed by connecting the coils of the electro-magnet and rotating armature, no spark occurs in the secondary coil. On account of the great resistance of the circuit, which now also includes the primary coil of the inductorium, the current is not in sufficient quantity to produce any noticeable inductive effect.

A very remarkable increase of all the effects is observed when a cross wire is placed so as to divert a great portion of the current from the electro-magnet. The four inches of platina wire, instead of flashing into redness and then disappearing, remains permanently ignited. The inductorium, which before gave no spark, now gave

* Communicated by the author, having been read at the Royal Society, February 14, 1867.

one half an inch in length. Water was more abundantly decomposed, and all the other effects were similarly increased.

I account for this augmentation of the effects in the following way:—Though so much of the current is diverted from the electro-magnet by the cross wire, the magnetic effect still continues to accumulate, though not to so high a degree; but the current, generated by the armature passing through the short circuit formed by the armature branch and cross wire, experiences a far less resistance than if it had passed through the armature and electro-magnet branches; and though the electromotive force is less, the resistance having been rendered less in a much greater proportion, the resultant effect is greater.

I must observe that a certain amount of resistance in the cross wire is necessary to produce the maximum effect. If the resistance be too small, the electro-magnet does not acquire sufficient magnetism; and if it be too great, though the magnetism becomes stronger, the increase of resistance more than counterbalances its effect.

But the effects already described are far inferior to those obtained by causing them to take place in the cross wire itself. With the same application of force 7 inches of platina wire were made redhot, and sparks were elicited in the inductorium 2¼ inches in length. The force of two men was employed in these as well as in the other experiments. When the interruptor of the primary coil was fixed, the machine was much easier to move than when it acted; for when the interruptor acted, at each moment of interruption, the cross wire being as it were removed, the whole of the current passed through the electro-magnet, and consequently a greater amount of magnetic energy was excited, while at the intervals during which the cross wire was complete, the current passed mainly through the primary coil.

The effects are much less influenced by a resistance in the electro-magnet branch than in either of the other branches. To reduce the length of the spark in the inductorium, the primary coil of which was placed in the cross wire, to ¾ inch it required the resistance of 5¼ inches of the fine platina wire in the cross wire, 5 inches in the armature branch, and 4 feet in the electro-magnet branch.

When there was no extra resistance in either of the branches, the length of the cross wire being only about a few feet, the intensity of the current in the electro-magnet branch compared with that in the cross wire was as 1 to 60, and when the resistance of the primary coil of the inductorium was interposed in the cross wire the relative intensities were as 1 to 42.

In conclusion, I will mention that there is an evident analogy between the augmentation of the power of a weak magnet by means of an inductive action produced by itself, and that accumulation of power shown in the static electric machines of Holtzman and others, which have recently excited considerable attention, in which a very small quantity of electricity directly excited is, by a series of inductive actions, augmented so as to equal and even exceed the effects of the most powerful machines of the ordinary construction.

To Recognise Wood Fibre in Paper.—The paper which is suspected to contain wood fibre is touched with ordinary strong nitric acid. If wood be present it is coloured brown, especially on warming. This reaction is more delicate than that with sulphate of aniline.—*M. Behrend, in Polyt. Notizbl.*, 1866, p. 288.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, February 19, 1867.

On the occasion of an incident of which we shall presently say a few words, we must allow ourselves to protest against a mania which has passed into the state of an intolerable abuse. As soon as any new question of importance is here raised, it is referred for examination to a commission; thus far there is nothing to complain of. But what we cannot comprehend is, that the members of the commission are chosen from so restrained a circle of administrative, scientific, and industrial notables, that the commissions which succeed each other are almost always composed of the same privileged persons. It thus happens, without noticing, that one same French *savant* forms part of a thousand different commissions—governmental, municipal, academical, financial, economical, agricultural, &c. If we were to mention the names of the commissions or the committees to which, for example, M. Dumas belongs, almost always in the quality of president, one would really be frightened; perhaps we should exceed the number of 1000, which seemed just now a hyperbola. Incontestably no one can be more *au courant* of the scientific progress in all its forms—nobody more enlightened than M. Dumas, nor more devoted to the interests of the country; but his science and devotion do not give him the gift of ubiquity, and his working day, like that of other mortals, consists at most of ten or twelve hours. To accept the post of member of a commission is to impose a certain duty upon one's self—to engage the conscience. How, therefore, can any man's permit him to so multiply his functions and his duties that it amounts to an absolute impossibility to fulfil even the thousandth part? One can scarcely believe how serious are the inconveniences of this lamentable monopoly; how many interests of great importance are often thus left in sufferance; how many honourable private interests are thus fatally abandoned or put in peril. Let us allow facts to speak for themselves.

There is in France a society unique of its kind—the Society of Encouragement for National Industry, founded in 1804, and recognised as an establishment of public utility since 1824. Thus it is considerable from the number of its members, the composition of its council, and the choice of the judges of the committees. It was formerly rich, when the editing and printing of its bulletin did not absorb a great portion of its resources. Its first president was the chemist and minister, Chaptal, who was replaced by the great name of M. Thénard. It has for actual president M. Dumas, the man, in fact, the best in a position to render it prosperous and glorious, if he could devote to it a sufficient portion of his valuable time; but the presiding at the Society of Encouragement is but the hundredth part of the presidencies of M. Dumas, and how to bring forward so many occupations which exclude one another. The fortunes, the force, the soul—if we may so call it—of the Society of Encouragement are the annual public meetings for the distribution of gold, platinum, bronze, and silver medals to industrials and inventors, diplomas of honour to foremen and workmen, &c., &c., in which also it regulates its balance-sheet and annual budget. If it wished, the Society could hold two solemn meetings, but its regulations imperatively require one, and the occasional reading of the reports, as well as the distribution of the prizes, are a sacred right for the interested parties who have submitted their discoveries or works to its judgment. To frustrate them is an injustice which can be calculated in money, for the different distributions of each annual meeting amount to, in the average, more than 400*l*. But in order that the Society can hold its annual meeting the President must be able to devote two mornings to assist at the general meetings of the committees for the awarding

of the medals, and an evening for their distribution. Thus, when one is member of 1000 commissions, committees, and societies, two mornings and an evening free, are, we repeat, an absolute impossibility, and that it happens that the year passes without the annual meeting of the Society of Encouragement, to the great detriment of the progress of industry and the arts, to the great injury of industrials and inventors, to the great lessening of the Society which cannot attract to it members and capital, except it shows itself lively and just to those who place their hopes in it. The absorption of the person of the President, M. Dumas, has been the cause that no annual meeting took place in 1853, 1855, 1859, 1861, 1863, 1866, and has thus frustrated for ever, or a time, the works, or the persons, or the objects of the reports, of a sum of more than 24,000*l.*, without taking into account the immense discouragement caused by these disastrous irregularities. But here is the worst part of this business. Making a generous effort, the committee had everything prepared for the Society to repair, in the first days of 1867, its negligence and silence of 1866. After much consideration, the honourable President thought that he could dispose of the evening of February 6, and fixed the annual meeting for that day. The good news was inserted in the *Moniteur Universel* of Friday, the 2nd, and repeated by all the papers. Letters of invitation were addressed to all who waited for so long a time for their rewards. And some of them who hastened to be present had the disappointment to read in the *Moniteur* of Monday, February 4, that the President, hindered from coming, had postponed the public meeting to February 20; that he, consequently, made the public wait fifteen long days, and that the weekly meeting of February 6 was confiscated. It is an unpleasant task for us to make these painful revelations, and we are ashamed to say that these acts should take place in France, the leading country in science, which would not be for an instant tolerated in any other country; and the more we feel grieved since no one more than us can have more admiration, respect, and affection for M. Dumas; but for us who have for so many consecutive years waited for the labours of the Society of Encouragement to come to a successful issue, it is obligatory to speak so as to render impossible henceforth the continuation of treatment so disheartening.

The Paris Exhibition of 1867.—Great International Lecture-hall.

We feel ourselves bound to realise an idea conceived by the Imperial Commission which will give the most ample satisfaction to scientific visitors of the Exhibition of 1867. The opening of a great lecture-hall like this, in which all sciences and arts will be prominently displayed by the most celebrated men, will certainly be the grandest effort of modern progress in science.

The main portion of the Exhibition, containing a collection of machines, apparatus and products of all nations, requires a vivifying soul to illustrate all the objects therein and to reveal the whole contents of the palace to the world one after the other. This lecture-hall, vast and well lit up—in the day by elegant stained windows, and in the night by electric, Drummond, magnesia, and magnesium, and by gas light in all its principal forms, applied in all apparatus hitherto invented—is to form an integral portion of the Exhibition. We have obtained the faculty of giving admission in the hall, with right of insertion in the catalogue, and of competing for all the prizes, for all industrials who could not obtain room in the space reserved for their specialty on account of their application being too late. Arranged as an amphitheatre, the hall can contain 500 persons, comfortably seated, with proper ventilation, cool air, &c., by the latest known scientific means.

To give a sketch of what is to be treated on in this interesting building on a thousand different subjects, both national and international, the following is the programme.

National Conferences.—These are to consist of historic and technical discourses.

Historical Lectures.—1. General history of progress under all its forms. 2. History of the principal branches of science, industry, and fine arts, illustrated by portraits of savants, inventors, and illustrious men.

Technical Lectures.—1. Exhibition of products or objects, under the eye or by the aid of photographic views, magnified and projected on a vast screen, the original works of the Universal Exhibition, to suit the lecturers. 2. Lectures given by exhibitors, or in their name, in order to bring their inventions, &c., before the public, or their services rendered for the public good.

International Conferences in French, or in the Language of other Nations.—1. Patriotic lectures required by the Commissioners of the different Governments. 2. Lectures on the progress of science, industry, and the arts, given by special lecturers; individual conferences solicited by the exhibitors.

The administration of the hall purpose being a sort of intermediary between the producer and the consumer, between the inventor and the manufacturer. Also, there will be ample means for the sale of products, patents, licences, &c., so as to render eminent services to all classes of exhibitors. This institution, the initiative of which emanates from the Imperial Commission, will certainly become a favourite place of resort, and we have reason to believe that it will be filled several times every day.

The lectures, printed and completed by the addition of supplementary pages, will contain the most faithful account of the progress accomplished and brought to light in the great enclosure of the Champ de Mars; so we hope that all inventors and industrials of the United Kingdom will give us an opportunity of distributing printed or manuscript documents which they will have to produce relative to their rights to the recompenses of the juries. They can be addressed to the office of this paper 1, Wine Office Court, Fleet Street, London, E.C.

Respiratory Apparatus and Obturators of Gas-pipes of M. Galibert.—This apparatus has become very popular in France and England. Public experiments have been made with it at Paris, London, Southampton, Cherbourg, Toulon, Brest, and many other towns, and the success has been wonderful. Its object is to protect life from the dangers of an irrespirable medium, no matter of what nature; penetrating and thick smoke, nitrous, sulphurous, or carbonic acids; sulphuretted hydrogen, nitrogen, coal gases, &c. It is composed essentially of a reservoir of air formed of a tissue, completely impermeable, which the operator carries with him wherever he wishes to enter. At first the reservoir was formed of goat-skins, similar to those which serve in Italy, Spain, the South of France, &c., for containing wine or oil. These sacks, from the great success of the apparatus, becoming more and more rare and dear, M. Galibert was obliged to have recourse to cylinders for artificial tissue, perfectly impermeable, and very strong, which he prepares by glueing together two strong linen and hemp cloths, each coated with eight layers of india-rubber varnish. They are filled in a few seconds by means of a small bellows, and are capable of containing eighty litres of air; they are carried on the back of the operator, like a knapsack, by means of straps. The communication between the air in the reservoir and the mouth and the respiratory organs is made by two tubes of india-rubber fixed, that of aspiration at the bottom of the reservoir, and that of expiration at the top of the bag, both tubes terminating in a sort of mouth-piece, which the operator places between his teeth. A strong clip prevents breathing by the nostrils, and the eyes are protected by two concave glasses set in a circular band of leather, which surrounds the head, and shuts hermetically. Thus provided with air, the operator can penetrate, and remain, without suffering, in the most mephitic and constant atmospheres. If his sojourn should

be further prolonged, he can carry with him several cylinders for exchange ready filled. He carries also suspended at his waist, which sounds on the hand being pressed against it, an india-rubber ball or tube, in case of danger. This respiratory apparatus has been definitively adopted by the companies of the Sapeurs-Pompiers or fire brigade of Paris, and of many departments, by several mining companies, the municipal administration of Paris, the General Gas Company, the Navy, &c., &c. It is absolutely indispensable for well-sinkers, sewerage workmen, those who repair the gas mains, &c.; also to those who are forced to penetrate into places where fermentation is going on, in distilleries of grain, or in manufactories of chemical products, or other industries where chlorine, nitrous acid, muriatic acid, or sulphuretted hydrogen abound. What frightful accidents might be avoided if the respiratory apparatus of M. Galibert, so simple, so efficacious, so economical, were, as it ought to be, generally adopted! The artificial tissue of M. Galibert is destined to render immense service in a great number of cases. A new application of it has been recently made. When a gas main has to be repaired, it is necessary to close the end of the tube next to the gasworks. The general practice is to close it up by an india-rubber sack or ball, uninflated, introduced into the aperture of the tube, and afterwards filled with compressed air by means of bellows. This system is attended with much difficulty. M. Galibert has proposed to M. Guiffrer and M. Lependry, directors of the General Gas Company of Paris, to substitute for the india-rubber balloons, cylinders of impermeable cloth, 30 to 50 centimetres long and of a convenient diameter, which, inflated with air, fill the cavity of the gaspipe and close it much more hermetically. The experiment was made on two tubes of different diameters with complete success. The obturator cylinders support a pressure double that at which the india-rubber globes yield without allowing the gas to pass, and retain 60 per cent. of the gas which the india-rubber stoppers let escape. The result is that for the town of Paris alone the substitution for the india-rubber balls of the cloth cylinders of M. Galibert, much less costly and incomparably more solid, effects an annual economy of more than 600*l*. Let us repeat again that the discovery of a tissue utterly impermeable to air, and very resistent, is an industrial achievement which is of great promise.

F. Moigno.

PROCEEDINGS OF SOCIETIES.

ROYAL SOCIETY.

Thursday, February 14, 1867.

General Sabine, *President, in the Chair.*

A paper was read "*On the Conversion of Dynamical into Electrical Force without the aid of Permanent Magnetism*," by C. W. Siemens, F.R.S. The apparatus employed in this experiment was an electro-magnetic machine consisting of one or more horseshoes of soft iron surrounded with insulated wire in the usual manner, of a rotating keeper of soft iron surrounded also with an insulated wire, and of a commutator connecting the respective coils in the manner of a magneto-electrical machine. If a galvanic battery were connected with this arrangement, rotation of the keeper in a given direction would ensue. If the battery were excluded from the circuit and rotation imparted to the keeper in the opposite direction to that resulting from the galvanic current, there would be no electrical effect produced, supposing the electro-magnets were absolutely free of magnetism; but by inserting a battery of a single cell in the circuit, a certain magnetic condition would be set up, causing similar electro-magnetic poles to be forcibly approached to each other, and dissimilar poles to be forcibly severed alternately, the rotation being contrary in direction to that which would be produced by the exciting current.

Instead of employing a battery to commence the accumulative action of the machine, it sufficed to touch the soft iron bars employed, with a permanent magnet, or to dip the former into a position parallel to the magnetic axis of the earth, in order to produce the same phenomenon as before. Practically it was not even necessary to give any external impulse upon restarting the machine, the residuary magnetism of the electro-magnetic arrangements employed being found sufficient for that purpose.

The mechanical arrangement best suited for the production of these currents was that originally proposed by Dr. Werner Siemens in 1857,* consisting of a cylindrical keeper hollowed at two sides for the reception of insulated wire wound longitudinally, which was made to rotate between the poles of a series of permanent magnets, which latter were at present replaced by electro-magnets. On imparting rotation to the armature of such an arrangement, the mechanical resistance was found to increase rapidly to such an extent, that either the driving-strap commenced to slip, or the insulated wires constituting the coils were heated to the extent of igniting their insulating silk covering.

It was thus possible to produce mechanically the most powerful electrical or calorific effects without the aid of steel magnets, which latter were open to the practical objection of losing their permanent magnetism in use.

The reading of this paper was followed by one "*On the Augmentation of the Power of a Magnet by the Reaction thereon of Currents induced by the Magnet itself*," by Professor Wheatstone, F.R.S. (see page 89). An animated discussion on these two papers followed.

CHEMICAL SOCIETY OF PARIS.

November 2, 1866.

M. Berthelot *in the chair.*

M. Schutzenberger announced that M. Bolley, who had hitherto disputed the formula of purpurine assigned by him, now admitted the formula $C_{10}H_6O_7$, which made purpurine an oxidation product of alizerine. There still existed a disagreement between M. Schützenberger and M. Bolley as to the constitution of the yellow colouring matter derived from alizerine. M. Schützenberger maintained his original opinions.

M. Berthelot stated that he had conducted further experiments on the action of potassium on hydrocarbons. Not only was acetylin, but cumol and naphthalin also were attacked by the alkali metal. The same might be said of reten, anthracen, and in general of the less hydrogenised hydrocarbons. Benzol and many other hydrocarbons rich in hydrogen are not attacked. M. Berthelot then explained his researches on the action of heat on hydrocarbons. (These have already been described in the Chemical News.)

M. Personne stated that, in the torrefication of caffein or coffee, a considerable quantity of salts of methylamine was formed.

M. Albert Roussille showed some characteristic reactions of the salts of rosaniline and rosaloluidine.

M. E. Willin presented in the name of M. Chydenius, Professor at Helsingfors (Finland), a note on "*Euxenite*." The author has demonstrated the presence of thorina in this mineral.

November 16, 1866.

M. Berthelot *in the chair.*

M. Gal gave an abstract of his researches on organic ethers.

MM. Friedel and Ladenburg stated that they had attempted to prepare a hydrocarbon having an analogous constitution to that of silicium-ethyl. Methyl-chloracetol, a derivative of acetone, reacting on zinc-ethyl at a mode-

* See Du Moncel sur l'Electricité, 1862, page 248.

rate temperature, produced a hydrocarbon, C_7H_{16}, isomeric with several other hydrocarbons already known.

M. Berthelot described the several hydrocarbons he had succeeded in obtaining by heating them 2 by 2, 3 by 3, &c.

M. Debray announced the production of several salts of alumina obtained by the action of zinc on neutral sulphate of alumina, or of chalk on alum. He had in this manner prepared a crystallised neutral nitrate of alumina having an analogous composition to that of nitrate of the peroxide of iron.

NOTICES OF BOOKS.

Watts' Dictionary of Chemistry. Part XXXVII. January, 1867. London: Longmans, Green, Reader, and Dyer.

We have already given full notices of the earlier parts of this valuable and standard book, and have to remark now that the present number yields to no former one in the interest of its contents.

We can do our readers a good service by quoting from the present part the following article as a type of the amount of the latest researches contained in its pages:—

"*Sodammonium*, NH_3Na, or, rather, $N_2H_6Na_2$(?) (Weyl, *Pogg. Ann.*, cxxi. 697; *Jahresb.*, 1864, p. 163). This compound appears to be formed when lumps of pure bright sodium are placed at one end of a bent tube, a quantity of silver chloride previously saturated with ammonia gas at the other; the tube is then sealed, the end containing the silver chloride heated in a chloride of calcium bath, and the other end immersed in cold water. The sodium then swells up, and is converted into a liquid which is copper-red by perpendicularly reflected, greenish-yellow by obliquely reflected, light, blue in thin films by transmitted light. As the silver chloride cools, and the ammonia gas is reabsorbed, the sodammonium decomposes, and pure sodium remains behind, having a dull surface and spongy texture. By again heating the silver chloride, the compound may be reproduced any number of times. A sodammonium amalgam appears to be formed by exposing in like manner to the action of ammonia gas a pulverulent amalgam of nearly equal parts of sodium and mercury. After two hours' action, the portion of the mass in contact with the surface of the tube exhibits a metallic lustre and a bronze-red colour, while the interior is dull and brick-red. This product can likewise exist only in an atmosphere of ammonia, being resolved, in a few hours after the cooling of the silver chloride, into ammonia, free mercury, and a sodium amalgam containing less mercury than the original amalgam.

"*Potassammonium*, $N_2H_6K_2$(?), is prepared like sodammonium, and exhibits similar properties. Other metallammoniums may be produced by the decomposition of sodium or potassammonium. Thus, when a mixture of a metallic chloride or oxide with an equivalent quantity of sodium is exposed in the manner above described to the action of ammonia gas, the gas is first absorbed by the metallic chloride (or oxide), and afterwards by the sodium, the sodammonium thus formed flowing over the metallic salt, and reacting upon it without much rise of temperature. With a mixture of barium chloride and sodium the reaction seems to be—

$$\underset{\text{Sodammonium.}}{N_2H_6Na(qy.\,Na_2?)} + 2NH_3 + Ba''Cl_2 = \underset{\text{Barammonium.}}{N_2H_6Ba''} + 2\underset{\text{Chloride of sodammonium.}}{NH_3NACl}$$

"Barammonium forms a deep blue liquid having a metallic lustre. Copper, mercury, and silver ammonium are obtained in like manner from their respective chlorides, and zinc ammonium from the oxide. These compounds are likewise very unstable, being resolved, even in the sealed tube, into metal (which appears grey, dull, and destitute of coherence) and ammonia. If in the arrangement just described the metallic chloride be replaced by an ammonium salt—*e. g.*, NH_4Cl or $(NH_4)_2SO_4$, similar reactions take place, and the tube becomes filled with a blue liquid, mixed with excess of ammonia. This blue liquid, which is also formed by the action of potassic hydrate on potass-ammonium, appears to consist of *ammonium itself*, N_2H_8. It is even more unstable than the metallammoniums, being resolved into ammonia and hydrogen, partly even before the reaction between the ammonium salt and the sodammonium is completed.

"*Tetrasodammonium*, NNa_4 (?).—Monosulphide of sodium brought in contact, in a sealed tube, with liquid ammonia, is converted (with transient formation of liquid ammonium) into an orange-yellow substance, which soon decomposes, leaving a white substance still containing ammonia. This residue gives off ammonia on exposure to the air, and the odour of ammonium sulphide when heated. It is perhaps formed in the manner represented by the equation—

$$4Na_2S + 8NH_3 = (NNa_4)_2S + 3(NH_4)_2S.$$

"*Tetrapotassammonium* appears to be formed in a similar manner. (Weyl)."

The concise form of the information, great in amount, contained in one short article, will serve to show the character of the others, without our alluding to them more fully. We may state that in this part of ninety-six pages are contained full details of what is known respecting sodium, silicon, and silver among the elements, many vegetable principles, and names of the chief minerals in which the preceding elements are found.

The essay on silver assaying is perfect in its clearness and comprehensiveness, and is decidedly *the* article of the present part. But it almost seems as if the information and authorities quoted are not given so fully as they were in the earliest parts, as if it were feared that the quantity of matter yet remaining required curtailing for the whole work to occupy the arranged limits.

In other words, must the matter be crammed in to occupy a given number of volumes, or must the number of volumes be increased to allow justice to the work?

We would urge, on the behalf of the readers of the Chemical News, an extension of the original scheme by another volume, or, if needs be, two more. The work is, indeed, a classical one, and well worthy all the pains bestowed upon it by its talented editor, and we hope that neither the authors, publishers, nor chemical readers generally will fail in their respective duties in completing a work, at present and thus far, without a rival. Our interest in the Dictionary is too deep to prevent our feeling an anxiety on its account. We hope, therefore, that the additions, which must be proportionate with the progress of modern chemistry, will not be interfered with by preconceived limits. We further hope that appendices will also be published, embracing discoveries and views only lately made known, bearing upon the subjects of the earlier articles. The publishers, by so enlarging their scheme, will well earn the thanks of the profession at large, and we feel sure that they will be fully encouraged by those who have appreciated and done justice to the merits of "Watts' Dictionary of Chemistry."

The Modern Practice of Photography. By R. W. Thomas, F.C.S. London: Harrison. 1866.

In this little manual the author confines himself exclusively to the one process in photography which he considers the best—viz., the production of negatives with wet collodion, and printing upon albuminised paper. This process is fully gone into, and every point of difficulty carefully explained, particular stress being laid upon those operations in which beginners are principally liable to fail, and which are absolutely necessary for the production of

perfect pictures. Thus, a chapter is devoted to instructions for cleaning the plates, and another for varnishing the negatives, both of them subjects to which the young photographer at first seldom attaches due importance. The relative merits of iodised and bromo-iodised collodions, iron and pyrogallic acid developments, &c., are carefully stated, while the formula for the nitrate bath insures the maximum sensitiveness, together with the entire absence of any injurious or unnecessary matter.

For those photographers who are willing to thoroughly master one process before yielding to the allurements of tannin, albumen, &c., this manual will be found all that can be desired.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Deutsche Industrie Zeitung. 1867. No. 4.

Rosenstiel "*On Lucine*—i.e., *Dried Gluten—as a Substitute for White of Eggs in Calico Printing.*"—J. Bremen "*On Engraving on Marble by means of Chemicals as a Substitute for Carving.*"—Reinsch "*On the Occurrence of Phosphoric Acid in Coals.*"

Journal für Gasbeleuchtung. 1867. No. 1.

Dr. Schilling "*On the Varying Quantity of Sulphuretted Hydrogen met with in Crude Coal Gas, obtained from divers varieties of Coal, and on the Quantitative Estimation thereof; with Description of an Apparatus to obtain these Results readily and rapidly.*"—L. Rambohr "*On Kreosote Gas and the valuable By-products obtained in its Manufacture.*"

Le Moniteur Scientifique. Nos. 241 and 242. 1867.

Rignon "*On quick Soap-making.*"—Brissé "*On the Nutritive Quality of divers varieties of Cheese.*"

Polytechnisches Centralblatt. 1866. No. 24.

Wyrouboff "*On the Colouring Matters met with in Fluor Spar.*"—Knapp "*On Matches without Phosphorus*"—viz., 3 parts of sulphuret of antimony, 16 chlorate of potassa, 1 bichromate of potassa, 10 red lead, 8 nitromannite, 4 glass, 5 gum.—Dr. Vohl: "*Results of Analysis of Crude Boracic Acid from Tuscany.*"—J. Kolb "*On the Density of Nitric Acid, with a Table.*"—Dr. Fleckner: "*Analysis of Bauxite from Feistrisz, in Carynthia.*"—Dr. Bolley "*On a Yellow Dye Stuff obtainable from Indigo in Crystallised State*"—*i.e.*, naturally occurring in indigo.

Le Technologiste. No. 325.

Henri Mares "*On the Influence of Heat on some varieties of Languedoc Wines.*"—C. Randtl "*On the Pressure which the Carbonic Acid, developed from Beer while in Fermentation and kept in Closed Casks, exerts upon the Process of Fermentation.*"

No. 326.—"*On the Varieties of Coloration of Brass.*"—Griess "*On Aniline Yellow.*"—Hauch "*On a Simple Process to Prepare from Crude*—i.e., *Native—Sulphur Flowers of Sulphur.*"—Violette "*On Resins.*"

No. 327.—Vysoky "*On the Manufacture of Uranium Yellow at Joachimsthal, in Bohemia.*"—Gerlach "*On the Specific Gravity of Solutions of Sulphate of Iron and Sulphate of Copper.*"—Grundmann "*On the Loss Mineral Fuel, especially Coal, Suffers in its Quality as Good Fuel by being Exposed to Air.*"

No. 328.—Fischer: *Researches on the Purple of Cassius.*"—Dr. Vohl "*On the Extraction of Fixed Fatty Oils from Seeds by means of Paraffin and other similar kinds of Oils.*"—Senefelder "*On Indelible Ink.*"—"*On the Explosive Force of Sodium.*" 30 grammes of sodium brought into contact with water explode with equal force as 9 kilogrammes of gunpowder, or 9 hectogrammes of nitroglycerine. 600 grammes of sodium in contact with a spoonful of water will do the same effect as 1800 kilogrammes (nearly two tons) of gunpowder.

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

64. L. Hand, Coleman Street, London, "Improvements in treating benzole and other hydrocarbon liquids, and in making such liquids non-explosive, and of generating an illuminating gas therefrom." A communication from J. Johnson, Wilmington, Illinois, U.S.A.—Petition recorded January 10, 1867.

73. F. J. Evans, Westminster, "Improvements in the manufacture of illuminating gas."—January 11, 1867.

87. W. G. Blagden, Hackney Wick, Middlesex, "An improved method of separating silver from lead." A communication from F. Marquez-Millan, Rue Liandier, Marseilles, France.—January 14, 1867.

119. E. Süvern, Halle, Prussia, "An improved mode of and apparatus for purifying the impure waters emanating from sugar factories and other industrial establishments, applicable also to the purification of sewage water."—January 17, 1867.

128. B. Lietar, Rue du Houblon, Brussels, "An improved composition to be employed in welding or soldering iron upon iron, steel upon steel, and iron upon steel."

130. D. W. Hamper, Newcastle-on-Tyne, "Improvements in the preparation of finings for fining or clearing fermented liquors."

131. J. G. Franklin, Broadway, Somersetshire, "Improvements in tanning."

134. W. Weldon, West Hill, Highgate, Middlesex, "An improved method of manufacturing chlorine."—January 18, 1867.

148. G. L. Loversidge, Greenfield, Saddleworth, Yorkshire, "Improvements in the tanning of hides and skins, and in the apparatus employed therein."

152. J. Rowley, Grosvenor Terrace, Camberwell, Surrey, "An improved process for hardening, bleaching, and sweetening crude paraffin."—January 21, 1867.

164. J. Patison, Airdrie, Lanarkshire, N.B, "Improvements in the production of illuminating gas, and in the manufacture and application or use of new or improved materials or fuels for the same, and in the means or apparatus employed therefor."—January 22, 1866.

172. H. A. Bonneville, Rue du Mont Thabor, Paris, "A new or improved process of treating skins, in order to separate therefrom the hair and wool, and in the preparation of the hair for the manufacture of hats." A communication from A. Frayssé, jun., Rue Croix-des-Petits-Champs, Paris.—January 23, 1867.

211. J. J. Lundy, Leith, Midlothian, N.B., "Improvements in the treatment of the residual matters resulting from and obtained in the purification and distillation of mineral or hydrocarbon oils, and also in the treatment of coal tar and various waste or other alkaline and lime substances for the purpose of utilising the same."—January 26, 1867.

Notices to Proceed.

2460. W. Cormack, Commercial Road, Middlesex, "Improvements in means and apparatus for effecting the revivification of animal charcoal."

2472. J. J. Lundy, Leith, Midlothian, N.B., "Improvements in the treatment of the residues resulting from and obtained in the purification and distillation of mineral oils, for the purpose of utilising the same."—Petitions recorded September 25, 1866.

2478. T. Amey, Petersfield, Hampshire, "An improved process for preserving milk, and apparatus connected therewith."

2479. J. C. Sellars, Birkenhead, Cheshire, "A new and improved metal founders' blacking, and mode of treating or preparing the same."—September 26, 1866.

2534. D. Barker, Northfleet, Kent, "Improvements in the manufacture of artificial fuel."

2645. E. Beanes, Priory Road, Kilburn, Middlesex, "Improvements in refining or decolorising sugar and syrup."—October 12, 1866.

2733. J. Greenshields, Glasgow, N.B., "Improvements in making gas and coke."—October 23, 1866.

CORRESPONDENCE.

Organic Matter in Water.

To the Editor of the Chemical News.

Sir,—"Silence" is said to give "consent," but I cannot suppose that Dr. Letheby wishes us to think that he consents to your correspondent, "Thomas P. Blunt, B.A., F.C.S." (*vide* Chemical News of Jan. 25), taking up the office of exponent of his views on water analysis, although he has treated the latter's letter with the same expressive silence that he employed towards mine.

Mr. Blunt flatters himself that his letter discloses a "method" which is "no doubt substantially identical with that in use by Dr. Letheby." This "method," he admits, is perhaps "not theoretically perfect," and, as Dr. Letheby has not offered to enlighten him, I may, perhaps, be allowed to point out to the latter that its "practical value" will appear rather diminished if he will be good enough to answer the following queries:—1. If a fresh solution of some nitrogenised organic matter of animal origin (*e.g.* albumen) were sent to Mr. Blunt for analysis, would he, because he detected no ammonia or nitric acid in the solution, return a report that "it contained no organic matter of animal origin?" 2. Does Mr. Blunt know that nitrogenised organic matter (say for instance, as before, albumen) has been found to form part of the constitution of vegetables? 3. Would he therefore, should a solution of such organic matter be sent to him for analysis, after the nitrogenised matter had been decomposed into ammonia and nitric acid, conclude and report that "the organic matter was entirely of animal origin?" 4. If Mr. Blunt should fail to detect ammonia or nitric acid in a sample of Thames water, would he conclude that the inhabitants of the towns above the point where the sample was collected had kindly omitted to pour any nitrogenised organic matter of animal origin into it that day—say, for instance, sewage, an occasional constituent of that river which Dr. Letheby pronounces to be "free from organic matter of animal origin?" 5. What "practical value" ("perfection in theory" seems to be considered by Mr. Blunt as of little importance) would conclusions such as I have described have?

Not content with explaining what he conceives to be Dr. Letheby's "method" of detecting "animal organic matter," Mr. Blunt calls our attention to the "beautiful system" by which the former expresses the "oxidisable organic matter" in water in terms of oxalic acid. The "theoretical perfection" of this "beautiful system" will be apparent to your readers when they reflect that Dr. Letheby seems to consider that his deep acquaintance with the "oxidisable organic matter" in water warrants him in selecting oxalic acid (not because of its being so certainly acted upon by permanganate of potash, or because it can be obtained very pure, but) because it is the best type of such organic matter we possess. They can also form some idea of its "practical value" when I tell them that the city analyst of Dublin, in a recent report, informs the public that he considers this typical place to be held by sugar. I need not ask Mr. Blunt whether permanganate of potash acts on oxalic acid and on sugar in the same degree. I am, &c.

B. J. G.

Standard Thermometers.

To the Editor of the Chemical News.

Sir,—As the question touched upon by your correspondent, "Zero," about standard thermometers is of considerable importance on account of the comparison of accurate thermometric observations—as, for example, those suggested by Drs. Compton and Aitkins for the careful observations of the temperature of the human body during disease—I venture a few words on the point.

In your article it is stated that Mr. H. C. Kay's instrument, as certified by Mr. Glaisher, differs 1½° from the instrument with a Kew certificate. This statement implies at once that there are either two standards in England, that of Kew and that of Greenwich, differing 1½° from each other, or that Mr. Glaisher must have made a mistake of 1½° by the comparison of this instrument. Now neither of these suppositions is probable, for it is not likely that the standards at Kew and Greenwich should differ to any measurable unknown amount, nor is it likely that a man like Mr. Glaisher would make such a mistake. It is, therefore, evident that we must otherwise account for this difference. I applied to Mr. F. Pastorelli, of 208, Piccadilly, one of the most careful and accurate manufacturers, for an explanation, which he was kind enough to give me at once. Mr. Pastorelli informed me that it was a fact, known to most practical and accurate manufacturers, that thermometers made in the usual way did acquire gradually an increasing index error which would reach the maximum of 1 to 2 degrees about a year after the manufacture, but remain then as good as constant. Mr. Pastorelli believes this increasing error to be owing to the contraction of the glass after its manufacture. He explained to me a process he followed to avoid this after-contraction as much as possible, but this I shall pass over as being merely important to manufacturers.

After the above explanation it is, therefore, very probable that Mr. Kay's instrument acquired this greater additional index error first after its comparison by Mr. Glaisher with the standard. But how have we to account for it that the instruments with the Kew certificates should not have acquired the same increased error? This may be that those instruments were originally more carefully made, or adjusted some time after their manufacture. But if such considerable errors are possible even in certified thermometers, it would perhaps be advisable to place at different easily accessible localities standard instruments which are carefully rectified, to enable any gentleman engaged in meteorological, medical, chemical, or other thermometric observations, to convince himself of the correctness of his instrument, so that an accurate comparison of different observers can easily be made. I am, &c.

A Subscriber.

Commercial Analyses.

To the Editor of the Chemical News.

Sir,—An instance illustrating the want of a proper understanding on all hands has lately come under my notice. Chemist A, or Professor B.—no matter which—receives a sample of artificial manure, with a request that he will give a determination of the nitrogen contained. The analysis is performed and the fee paid; we will suppose it was one guinea, or, if under a contract for a considerable number, it may be half a guinea each all round. The amount of nitrogen is small, not more than an ordinary superphosphate generally contains, say 0·27. A dispute arises between the manufacturer and his customer, who may be a member of a farmers' club; an investigation follows, and in the course of a week or two, or it may be more, during which the poor manufacturer loses his trade among the members of the club, the secret is told. The chemist has

only tested by lime- and soda-combustion for ammonia from organic sources, or salts of ammonia, nitrate of soda being entirely overlooked, because the process is troublesome and the fee small. The manure in question is now found to contain 12 per cent. of nitrate of soda, or about 2 per cent. more nitrogen than the chemist or professor had reported. But now it is the chemist's turn to be on his trial, and his plea is that the fee is inadequate for the work required. Granted by all means. But if so, why undertake it? You go to your solicitor, and give him instructions to draw a will, a lease, or a settlement, it may be, for one of Professor B's daughters; you ask the cost; the price is agreed. Ten years hence your will is found to be bad and invalid, your lease full of omissions, or Professor B.'s daughter loses all her fortune through the bungling of the solicitor. Now, what solicitor in his senses would plead, as an excuse, that the fee was too small? or who would not call him a rogue for undertaking the work at all, well knowing that his client was only throwing away his money?

While we have chemists so devoid of proper professional feeling that they will work for almost any fee, of course the public will employ them. But even if chemists like to work *gratis*, I submit they are bound to do their work properly or not at all. I am, &c.

COMMON-SENSE.

Sudden Irruptions of Fire-damp in Mines.

To the Editor of the CHEMICAL NEWS.

SIR,—In your notice on the 11th ult. of Mr. Ansell's very ingenious fire-damp indicator for coal mines, you speak of sudden irruptions of fire-damp to such an extent as to render the air of even a mile of space explosive in a few minutes. I presume this means a mile in length of air-course, not a square mile of mine excavation; but is this circuit even of a mile in length, say 5000 feet of air-course of, say, 10 feet wide by 5 feet high, 50 square feet —*i.e.*, 250,000 cubic feet of safe air—rendered explosive "in a few minutes?" Of course that is quite possible, if the air is at first only just non-explosive; but is it true that so large a bulk of air giving no indication of fire-damp does become explosive in a few minutes from the sudden evolution of gas from the coal? Of course it may, if there be a large collection of gas in a goaf or other abandoned or neglected workings disturbed by an extensive fall of roof, or by powder blasting or expanding into the workings by sudden and great fall of the barometer; but that there should be a sudden increase of gas produced, beyond the usual power of the ventilation to dilute, of some 20,000 or 25,000 cubic feet direct from the coal in a few minutes is contrary to the usual opinion of miners, and seems very improbable. It is a very common opinion that if no indications of the presence of fire-damp be discoverable in the morning, there is no risk of any large explosion extending throughout the mine during that day, if the ventilation then found sufficient be maintained. It is allowed that small local explosions may nevertheless occur from local increase of gas evolved by blowers appearing or increasing, but that a large general explosion is next to impossible, from the great improbability of a great number of blowers suddenly increasing their discharge at the same time, unless, indeed, there be a great fall of the barometer, which rarely occurs during a few minutes. It is very important that this point should be settled, for many persons contend that the simple occurrence of a *large* explosion all but absolutely proves either that there must have been a very considerable accumulation of gas in the mine for some hours, perhaps days, previously, or that the ventilation of the part exploded had been considerably diminished. I believe one of these would be generally the correct conclusion; but, if it be not so, mine managers are likely to be accused of negligence when they have not been really guilty, and the absolute necessity for some much more immediate indication of danger than is now in use will be established. My hope and expectation is, that Mr. Ansell's indicator will supply this great and urgent want, and that by its means the master's eye will in effect always be present in the depths of the mine, keeping those alert on whose never-ceasing care the ventilation, and with it the safety of hundreds, depends. I am, &c.

P. H. HOLLAND.

London, February 6.

MISCELLANEOUS.

"**Buckmaster's Physiology.**"—In our notice of this book a few weeks ago we invited an explanation of the strange title of the book, Mr. Angel being the author. Mr. Angel has sent us a long answer to the inquiry, and we regret that we have not the space to give it *in extenso*. He tells us that he knew that the work would be published in Buckmaster's series, but quite expected that "his name would be published as the author in the same way as that of Dr. Carpenter or Dr. Wilson in Bohn's or Chambers's series," and was himself disappointed by the manner in which the work was bound up. We see no reason why the publisher should not, thus late, satisfy Mr. Angel's natural wish that no doubt should be left as regards the authorship.

Meetings for the Week.

Tuesday, February 26.

Royal Institution, 3 p.m. Professor Tyndall, F.R.S., "*On Vibratory Motion and Sound.*"

Royal Medical and Chirurgical, 8½ p.m.

Wednesday, February 27.

Society of Arts, 8 p.m.

Thursday, February 28.

Royal Institution, 3 p.m. Professor Tyndall, "*On Vibratory Motion and Sound.*"

Royal Society, 8½ p.m.

Friday, March 1.

Royal Institution, at 8 p.m. Captain V. J. Majendie, "*On Breech-loading Small Arms.*"

Saturday, March 2.

Royal Institution, at 3 p.m. G. A. Macfarren, Esq., "*On Harmony.*"

ANSWERS TO CORRESPONDENTS.

Assayer, Chemicus (Liverpool), and others, next week.

Dr. F.—A process such as you describe would be of great value, but we do not consider that you have solved the difficulty.

Therma.—Breguet's metallic thermometer will be the best for your purpose. Siemens' electric resistance thermometer would be unsuitable.

George T.—Arsenic and tin in solution may be separated by converting them into sulphides, and dissolving the sulphide of arsenic in bisulphite of potash. Sulphide of tin is insoluble in this.

A. S. L.—Probably you mean benoleic acid, a derivative of bromerucic acid. It was discovered by Hausknecht. We never heard of benoteic acid.

Prussian Blue.—"Chromium" inquires for a likely market for a good and cheap Prussian blue pigment, which he has facilities for making.

Spirit of Nitrous Ether.—In our report of Professor Redwood's paper given in our last number, page 79, in speaking of the 1864 process, *nitrate* of potash was mentioned as possessing the indefinite composition complained of. Our readers will perceive at once that this is a clerical error, nitrite of potash being meant.

Child.—Putrefaction or decomposition will not *produce* animal life in the sense you mean; but the germs of life being present, their development is frequently the cause of putrefaction, whilst sometimes their development is hastened by the decay of body in which they find themselves.

A Confectioner.—Essence of apricot is made by mixing 1 part of chloroform, 10 parts of butyrate of ethyl, 5 parts of valerianate of ethyl, 1 part of œnanthylate of ethyl, 2 parts of salicylate of methyl, 1 part of butyrate of amyl, 1 part of cold saturated solution of tartaric acid in alcohol, and 4 parts of glycerin. The whole to be dissolved in 800 parts of alcohol.

Titration of Ethers.—A Subscriber writes:—"I was not present at the meeting of the Chemical Society at which Prof. Wanklyn brought forward the above subject. I now beg to express my regret for having thus, unwittingly, done injustice to Prof. Wanklyn's knowledge of chemical literature."

IRRUPTIONS OF FIRE-DAMP IN COAL MINES.

In a notice of Mr. Ansell's ingenious indicator given a few weeks ago, we spoke of sudden irruptions of fire-damp to such an extent as to render the air of even a mile in extent explosive in a few minutes. There are very many recorded cases of sudden irruptions of fire-damp in such quantities as to far surpass the amount quoted in our recent article; but as Mr. Holland, in our last number, raised the question, and appeared to consider that such cases, even if occurring, were at all events very exceptional, we propose to give the subject a greater consideration. We quote from a paper written by Mr. John Brown—who is admittedly the most trustworthy mining engineer in South Yorkshire—and we think that the following cases are in point as regards Mr. Holland's communication. Speaking of an explosion which occurred at the Shipley Colliery in 1851, he says:—"It was known that the coal and the strata in connexion with it yielded fire-damp; but no great quantity had manifested itself until August 8, 1851, when an explosion took place in the evening, whereby several persons were burned, &c. . . . . In a few minutes afterwards this was followed by an explosion at the furnace." Upon examination it was discovered that the floor in one of the stalls "had been violently upheaved; one side of the tramway which crosses the face of the workings being raised nearly two feet higher than the other, and fire-damp was issuing in large quantities from the fissures. It being night, the gas had passed till it came in contact with a candle. After exploding here, a sufficient quantity passed to the furnace to produce a second explosion." After detailing two other sudden irruptions, the writer goes on to express an opinion "that no amount of ventilation that could be produced in that mine would prevent an explosion either at a naked light or at the furnace, or at both.

Again, in speaking of the Oaks Colliery at Barnsley, he says:—"In January, 1857, a large quantity of gas was given off suddenly in the dip works;" he thinks from the roof. He continues:—"The men in this district immediately retired, their lamps being extinguished. No person was working near the upcast pit, so I am unable to state in what condition the return air was when it arrived at the pit; but it must have been very much charged with fire-damp." Again: "In August of the same year a very much larger issue of gas took place in a bank in the dip workings, coming off from the floor, which was much heaved up and broken. The noise made by the gas rushing violently was quite alarming. From the point of issue, which was in the bank nearest to the intake, to where the last man was working was about 400 yards; and along this line part of the men were working with Stephenson's and the remainder with Davy's. The whole of the former were extinguished, and the latter became red-hot before the wicks could be drawn down, but most fortunately they were put out without an accident." "There can be no doubt," says Mr. Brown, "that if the return air had passed over a furnace, an accident of a frightful character must have happened." Once more: speaking of the Oaks Colliery in September, 1858, the author from whom we have so freely quoted says:—"Early in the morning the man whose duty it was to examine the pit prior to the colliers going to work, discovered that a fall of roof had taken place on the south side of the pit. The gas continued to come off rapidly for four or five hours. I made some calculations at the time which convinced me that *at least* as much pure fire-damp came off that morning as would have filled a heading six feet square and a mile and a half long; probably there was much more than this."

Such an amount of *pure* fire-damp diluted to the explosion point would in twenty minutes or less render a mile perfectly explosive, but, as a more recent case, Mr. Ansell has recorded that he was present in a pit when an enormous amount of gas suddenly issued, having been released by blowing out a block of coal which stood square and up to his waist—he believed considerably more than a ton—and, at a distance exceeding 400 yards, heard this gas roaring in such a manner as to cause alarm; upon reaching the spot, he found that the gas was issuing from a funnel-shaped opening, into which he thrust his arm up to the shoulder. It is admitted on all hands that the gas issues from great reservoirs under considerable pressure, but Mr. Ansell seems to have satisfied himself that it exists in a liquid state, and he has seen cavities in which he thinks it is more than probable the liquid was retained.

TECHNICAL CHEMISTRY.

*The Theory and Working of Blast Furnaces, by Wm. Crossley, F.C.S., Manager Ormesby Iron Works.**

Perhaps no part of "furnace chemistry" is so little understood as that connected with the manufacture of iron in a blast furnace, and yet experience and frequent experiment have gradually improved the appliances and construction of blast furnaces, and shown the conditions under which they work most favourably, until at the present time I do not know of any other manufacture that is carried out on such a systematic and gigantic scale, nor one which promises at no distant period to be more thoroughly understood. Of course, in some of the older districts, and especially with those firms who have long had a name for the quality of the "pig" or "merchant" iron they produce, and a demand which places them above competition, the appliances and the process of manufacture are very primitive; but in the modern districts, and especially in Cleveland, every advantage is taken of all the discoveries and appliances that seem at all likely to answer the purpose for which they are intended; and the enterprising spirit shown by the ironmaster in the erection of improved plants and the alteration of old plants, to decrease the cost, improve the quality, and increase the make of iron, is worthy of all commendation.

I purpose in the present communication to point out some of the improvements that have been made, give some explanation of their effect, and, if possible, show in what direction any further efforts we may make ought to tend.

* Communicated by the author.

In a blast furnace the fuel and the material on which it has to act when undergoing the process of combustion are introduced together at the top of the furnace, and it takes from twenty-four in some of the older furnaces, to forty-four or even fifty hours in those most recently built, before it reaches the "crucible" part or the hearth, where combustion is going on, the cast iron formed and melted, and the slag allowed to escape. To assist ourselves in fully understanding the subject, it will perhaps be the best plan to follow the material in the changes it undergoes from its introduction at the top to its elimination as slag and iron at the bottom.

In an ordinary-sized furnace the material will be introduced about forty feet from the point of combustion or the tuyeres,† and hence it will be very gradually raised from the temperature at which it comes from the calcining kilns to the highest temperature of the furnace, and it is probable that the largest pieces of ironstone or limestone will be of nearly the same uniform temperature when they reach the point where limestone and ironstone act on each other, and combine to produce slag.

The first effect due to the hot gases produced by combustion passing through the furnace will be to raise the temperature of the material through which it passes up to that point where limestone is decomposed into carbonic acid and quicklime (and when the evolution of gases commences it is likely that the temperature will not increase as quickly as before this point is reached, owing to the liberated gases removing a portion of the heat of the furnace with them); at this point, too, any volatile or organic matter left in the stone by imperfect calcination will be driven off. It is probable, too, that near this place the peroxide of iron in the iron ore is sufficiently heated for the carbonic oxide to act upon it and reduce it to the metallic state, and this action will continue until at last all the iron will be distributed through the stone in the metallic form. The intensely heated material now travels on, the intensity of heat increasing as it approaches the "hearth" until at last the "melting region" is reached, where the earthy matter in the ironstone melts, and, acting on the limestone, the production of slag follows; a little below this the reduced iron will also melt, and at the same time probably combine with a portion of the carbon of the coke; nearer to the tuyeres still, some or all of this combined carbon may be resolved into the "graphitic" form, traces of silica, lime, &c., reduced and alloyed with the iron, and cast iron result.

We will now in like manner attempt to follow the blast in at the tuyeres, and to explain the changes it takes part in before finally leaving the furnace as "furnace gas."

The blast will probably first combine with the carbon of the coke, and produce carbonic acid; this will heat another portion of the coke sufficiently to enable it to reduce the carbonic acid to carbonic oxide ($CO_2 + C$ becomes $2CO$), and this intensely heated carbonic oxide will ascend in the furnace, gradually cooling as it ascends, owing to abstraction of heat by the material through which it passes. Higher in the furnace the carbonic oxide meets with unreduced oxide of iron, from which it abstracts the oxygen, producing an equivalent of carbonic acid; this carbonic acid is thought by some to be wholly or partially reduced again to carbonic oxide. For reasons which will be stated immediately, I have some doubt about this being the case, but certainly the greater part of the oxygen introduced in the blast leaves the furnace combined with carbon as carbonic oxide. This, of course, is mixed with the nitrogen of the atmosphere, the carbonic acid from the limestone, and the volatile matter not driven off during the process of calcination.

It is hoped that ultimately the analysis of furnace gas may lead to a better knowledge of the changes which take place in a blast furnace in the reduction and smelting of cast iron, but those already published are extremely unsatisfactory in some respects, either from the bad choice of furnace from which the gas analysed has been collected, or from the fact that there have been so many interfering circumstances at the time that it is difficult to draw any reliable conclusions from the results obtained. I have devoted a great deal of time to the examination of the analysis made by Ebelmen at Clerval and Audincourt in France, and at Seraing in Belgium; by Bunsen and Playfair at the Alfreton furnaces, England; by Bunsen, at Veckerhagen; and, lastly, by Scheerer and Langberg at Baerum, in Norway. I found it impossible from the reasons named to gain any information of value, with perhaps one exception—viz., in the case of the analysis of gas from a furnace at Clerval in France, by Ebelmen, a French chemist, which analysis seems to point to the fact that there is not that constant series of changes from carbonic oxide to carbonic acid, and from carbonic acid to the oxide, which has always been supposed to be the case, but that all the carbonic acid produced by the oxygen of the iron ore combining with the carbonic oxide leaves the furnace as carbonic acid, and is not again reduced to carbonic oxide—in other words, that the temperature at which oxide of iron can be reduced by carbonic oxide is below that at which carbon can remove an equivalent of oxygen from carbonic acid.

(To be continued.)

† In some of the larger furnaces the material is introduced seventy feet from the tuyeres, and in two furnaces recently built by Messrs. Bolckow and Vaughan, at Eston, the height of the furnaces has been increased to ninety-six feet.

On a New Process of Organic Elementary Analysis for Substances containing Chlorine, by C. M. Warren.

(*Concluded from page 74*)

III. *Experiments with Oxide of Zinc, as an Absorbent of Chlorine in the Analysis of Substances Rich in Hydrogen.*

In these experiments, the oxide of zinc was employed in the same manner as above described for the analysis of chloroform. The chloride of amyl, which was the subject of analysis, was prepared in the usual manner. Its boiling point was 102°, 8 corrected.

The following results of two analyses with oxide of zinc indicate that this oxide combined with and retained some of the carbonic acid. This result was not anticipated, as in the analysis of chloroform the determination of carbon was uniformly slightly in excess.*

* Since the above was written, I have observed, on reviewing my notes—not only of experiments with oxide of zinc, but also with oxide of copper—that in every analysis in which I made note of carbonisation, or blackening of the asbestos in the combustion tube—which may sometimes occur from too rapid distillation of the substance, or, what amounts to the same thing, a deficiency in the supply of oxygen—there was a loss in the determination of the carbon, and generally, also, in that of the chlorine; while the hydrogen would agree pretty nearly with the theoretical quantity. I am, therefore, at the present writing inclined to suspect that the carbonisation may have had some connexion with the deficiency in the carbon determinations in these instances, although the blackening would readily and completely disappear so soon as a sufficiency of oxygen was supplied. This momentary blackening of the asbestos occurred in both of the analyses of chloride of amyl with oxide of zinc, but, as already intimated, was not regarded at the time of serious consequence, as similar phenomena in the analysis of hydrocarbons by my process were generally attended with good results. It may, therefore, remain an open question, whether the oxide of zinc may not serve a good purpose in the analysis of substances of the class now under consideration.

The results of these two analyses are as follows :—

1.—0·1922 gramme of chloride of amyl gave 0·3513 of carbonic acid, 0·1854 of water, and 0·2528 of chloride of silver.

		Calculated.		Found.
Carbon .	C_{10}	60	56·3910	49·85
Hydrogen .	H_{11}	11	10·3383	10·72
Chlorine .	Cl	35·4	33·2707	32·47
			100·0000	93·04

2.—0·1657 gramme of chloride of amyl gave 0·3314 of carbonic acid and 0·1608 of water.

		Calculated.		Found.
Carbon .	C_{10}	60	56·3910	54·56
Hydrogen .	H_{11}	11	10·3383	10·74
Chlorine .	Cl	35·4	33·2707	

IV. *Experiments with Oxide of Copper, as absorbent of Chlorine in the Analysis of Substances Rich in Hydrogen.*

In these experiments, for the reason previously stated, the oxide of copper could only be placed in the anterior end of the combustion tube, where it might be maintained at a tolerably low temperature. After two or three experiments—which were but partially successful—it became apparent that the range of temperature within which oxide of copper could be made serviceable to absorb the chlorine was probably rather limited.

It was observed, for example, that at 150° to 160° even brown oxide of copper, which had been but gently ignited, would fail to absorb nearly all of the chlorine, and consequently the determination of the carbon, and sometimes that of the hydrogen, would be in excess. In one experiment, in which the oxide of copper was kept at about 153° C., its appearance had suffered no change, and it was found to contain only 8·29 per cent. of chlorine, or only about one quarter of the theoretical quantity. When a sufficiently high temperature is employed, on the contrary, the posterior end of the column of oxide of copper and asbestos has the appearance of being entirely changed into yellow chloride of copper, the rest of the column remaining, for the most part, of its original dark colour.

In another experiment, with the oxide of copper kept at a temperature of about 160°, only about 14 per cent. of chlorine was obtained.

In both of these experiments the carbon determination was considerably in excess, and in one of them the hydrogen also. The oxide of copper employed had been strongly ignited.

Before proceeding further with these somewhat random experiments, it was deemed advisable to determine the temperature at which chloride of copper begins to give off chlorine, in order to know how far it would be safe to raise the temperature of the air-bath in conducting an analysis. By making use of the air-bath to regulate the temperature of the chloride of copper, this determination was easily made. During the heating of the chloride, a current of air from the air gasometer was admitted through the tube in which it was contained.

Observations.—At 243° not a perceptible trace of chlorine was given off. After the lapse of fifteen minutes, at 250°, the nitrate of silver, into which the gas was conducted, was observed to be slightly milky; this may, therefore, be taken as about the temperature at which chloride of copper begins to suffer decomposition. At 267°, a solution of nitrate of silver was instantly precipitated.

Thinking that perhaps the small quantity of chlorine evolved under these circumstances might be taken up again and retained if oxide of copper were present, and possibly, also, that in that case a higher temperature might be safely employed—to make the conditions of the experiment conform in this particular to those which exist in an analysis, all but one inch of the chloride of copper was removed from the tube, and in its place was put a mixture of asbestos and oxide of copper, occupying a space of four inches in length, forward of the chloride. The experiment was then repeated. Prolonged heating in a current of air, and afterwards in oxygen, during which the thermometer rose to 350°, produced no reaction with nitrate of silver. From this it appears that the chlorine, which is given off below this temperature from chloride of copper, when this is mixed with oxide of copper, is absorbed and retained by the latter; hence, that so high a temperature as 350° may be safely employed for the air-bath in conducting an analysis by this process.

Analysis 1.—In this analysis the oxide of copper employed was prepared in the ordinary way and strongly ignited. The space in the tube occupied by the mixture of asbestos and oxide of copper was five inches in length, and contained just five grammes of the oxide. During the experiment, the temperature of the air-bath was maintained at about 350°. At the close of the combustion there was no appearance of chloride of copper, except in the first half inch at the back end of the column of the mixture of oxide of copper and asbestos, showing that the temperature employed was favourable for rapid and complete absorption of the chlorine.

Results of the Analysis.—0·1682 gramme of chloride of amyl gave 0·3486 of carbonic acid, 0·1633 of water, and 0·2233 of chloride of silver.

		Calculated.		Found.
Carbon .	C_{10}	60	56·3910	56·522
Hydrogen .	H_{11}	11	10·3383	10·761
Chlorine .	Cl	35·4	33·2707	32·773
			100·0000	100·056

Analysis 2.—The oxide of copper employed was of the same preparation as that used in Analysis 1. The space occupied by the mixture of asbestos and oxide of copper was only three and a half inches in length, but contained the same quantity—viz., five grammes of the oxide of copper—as used in the previous analysis. The temperature of the air-bath ranged from 250° to 253°. At the close of the combustion, it was found that all but three-quarters of an inch at the forward end of the column of mixed asbestos and oxide of copper had the appearance of containing chloride of copper. By comparison with the corresponding observation in Analysis 1, it will be seen that the appearance of the chloride extends over more than five times the space in this analysis that it did in the former, showing that with strongly ignited oxide of copper a temperature higher than 250°, even as high as 350°, is more favourable for the absorption of the chlorine. The following results of the analysis, however, are equally accurate with those of the preceding analysis.

0·1669 gramme of chloride of amyl gave 0·3457 of carbonic acid, 0·1612 of water, 0·2213 of chloride of silver.

		Calculated.		Found.
Carbon .	C_{10}	60	56·3910	56·489
Hydrogen .	H_{11}	11	10·3383	10·785
Chlorine .	Cl	35·4	33·2707	32·732
			100·0000	100·006

Analysis 3.—Under the impression that an oxide of copper which had been strongly ignited might be effectual to absorb the chlorine at a lower temperature, I employed in this and the two following analyses a preparation of brown oxide of copper, obtained by precipitation with potash and ignition over an ordinary gas flame. In this analysis the temperature of the air-bath ranged from 150° to 158°. The space occupied by the asbestos mixture was 4 inches in length, and contained 3 grammes of the oxide. Although the results of the analysis indicate that the temperature of the air-bath was too low, they also show, by comparison with the results obtained in operating with strongly ignited oxide at about the same temperature of the air-bath, that the brown oxide is decidedly preferable in respect to the temperature required. This was also shown by the appearance of the oxide after combustion—the newly formed chloride being confined, in the case of the brown oxide, to a much shorter space.

Results of the Analysis. — 0·1640 gramme of chloride of amyl gave 0·3504 of carbonic acid, 0·1562 of water, and 0·1884 of chloride of silver.

		Calculated.		Found.
Carbon .	C_{10}	60	56·3910	58·268
Hydrogen .	H_{11}	11	10·3383	10·582
Chlorine .	Cl	35·4	33·2707	28·360
			100·0000	97·210

Analysis 4.—Used the same preparation of oxide of copper as in Analysis 3, viz., the brown oxide. Temperature of the air-bath reached 170°. Slight carbonisation occurred just at the close of the combustion, from extending the heat backward too soon, under a wrong impression that the substance was all burnt. Were it not for this circumstance it is believed that this would have been a good analysis, although the temperature of the air-bath was kept so low. That a higher temperature of the bath is desirable, however, is shown by the fact that the chloride of copper appeared diffused over a space of $2\frac{1}{2}$ inches. The length of the column of mixed asbestos and oxide of copper was only four inches in this experiment, containing but one gramme of the oxide.

Results of the Analysis. — 0·1568 gramme of chloride of amyl gave 0·3195 of carbonic acid, and 0·1522 of water.

		Calculated.		Found.
Carbon .	C_{10}	60	56·3910	55·574
Hydrogen .	H_{11}	11	10·3383	10·784
Chlorine .	Cl	35·4	33·2707	

Analysis 5.—The oxide of copper employed was of the same preparation as that of Analyses 3 and 4. The temperature of the air-bath, however, was considerably higher, ranging from 240° to 247°. The mixture of asbestos and oxide of copper occupied a space of five inches in length, but contained only two grammes of the oxide. At the close of the combustion there was no appearance of chloride of copper, except at the back end of the column, a space of three-quarters of an inch in length.

Results of the Analysis.—0·1631 gramme of chloride of amyl gave 0·3383 of carbonic acid, 0·1557 of water, and ·2157 of chloride of silver.

		Calculated.		Found.
Carbon .	C_{10}	60	56·3910	56·542
Hydrogen .	H_{11}	11	10·3383	10·607
Chlorine .	Cl	35·4	33·2707	32·649
			100·0000	99·798

It can hardly have escaped observation that the quantity of oxide of copper or oxide of zinc required to absorb the chlorine by this process is extremely small, in consequence of its being uniformly diffused through a large mass of asbestos; hence it is obvious that but little of a solvent is needed to extract the chloride. In this respect the new process bears a striking contrast to the old one, which involves the use of a large quantity of lime, necessitating a corresponding quantity of acid, and introducing disagreeable manipulation, which tend to increase the liability to error.

I have not yet tried the process recently described by Carius,† as the difficulty which I had found in obtaining tubes that would bear the pressure incident to his process for the determination of sulpuur gave no encouragement of better success in the use of his process for the determination of chlorine, which is performed in a similar manner, although more complicated.

The advantage which my process affords, of being able to determine the three elements carbon, hydrogen, and chlorine at a single combustion, without the introduction of any difficult or hazardous manipulation, induces the belief that it will be found preferable to any other that has been devised.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, February 26, 1867.

At the last meeting of the Photographic Society of France, M. Decagny expressed the very correct opinion that too much attention is generally paid to the iodising of the collodion; that it should be devoted almost entirely to the developer, and, thanks to that, we can obtain the same rapidity with the dry collodion process as with the wet process. In corroboration of this idea he showed proofs taken with very small diaphragms, a very feeble light, and a relatively short time of exposure; they were remarkably sharp and clear, as regards perspective and relief, and their perfection was due to a mode of development suited for a dull light.

M. Klein presented a new enlarging apparatus on Woodward's principle, but which he considers he has greatly improved. The light is produced by four lenses—two before and two behind the proof; the object-glass is suppressed, and there is no spherical aberration. The operation can be carried on in clear weather, without direct sunshine. With salted or albuminised paper a positive proof of perfect clearness can be printed in twenty-five minutes on a sheet 45 by 57 centimetres, and in forty or fifty minutes on a double sheet.

M. Pinel-Pechardière presented several specimens of chromo-lithographic impressions vitrified upon different organic substances, accompanying them with the following note:—In order to vitrify a photo-lithograph by the processes of sprinkling or stencilling employed in porcelain, earthenware, or glass decoration, a single design is not sufficient in general, even when it relates to a monochromic image; two are necessary. In order to obtain, in varied colours, a monument, view, &c., it is absolutely necessary, as in chromo-lithography, to have a design on stone for each colour. All these designs are obtained on the stone, by solar radiation, from a single proof. On his part, M. Dagron, of 66, Rue des Petits-champs, Paris, has shown us porcelains, earthenware, crystal glass, with portraits and photographic views of a beautiful effect, which he obtained by a very simple, efficacious, and economical process. He is only waiting for more brilliant results to produce them on a large scale.

† *Annalen der Chemie und Pharmacie.*

M. Charles Nègre, of Avignon, mentioned that he has followed up his process of heliography on steel. The steel plate, covered with Judean asphalte, or a layer of gelatine mixed with bichromate of potash, is printed upon by the sunlight through the wrong side of a negative obtained directly in the camera; thus, the coating of varnish being impressioned by the parts which correspond with the shadows of the proof, the steel plate is exposed in the parts which correspond with the lights. Steeped in a gold bath, and submitted to the action of a current of electricity, the steel plate receives a uniform layer of gold on the parts corresponding to the lights of the proof; while the portion covered by the shadows, covered with sensitised varnish, only becomes covered with the particles of the gold in proportion to the intensity with which the light has acted in the different tints and in the tones of the shadows. On removing the coating of varnish from the steel plate, it presents only an image formed by a deposit of gold, perfectly inherent—a truly shaded sort of Damascus work. The gold being unattackable by acids, all that is necessary is to pour on the plate diluted acid, in order to obtain an engraving presenting all the shades of tint, from the clear white of the paper to the deepest black, at the same time preserving the precision, fineness, and sharpness of outline of the photographical proofs. The steel plate thus engraved, being able to furnish a great number of proofs, will be able to give faithful proofs on subjects of history, archæology, natural history, and all the sciences which require drawings of a mathematical exactness. The plates thus prepared can also be improved, added to, or altered in any way the artist may choose—an immense advantage, which a photographic proof does not possess.

Steam Ice Machines of M. Toselli, 236, Rue du Faubourg Saint-Martin.—We had scarcely mentioned the complete success of the steam refrigerators of M. Toselli when H.M. the Emperor of the French expressed a desire, through General Favé, of seeing this ingenious machine at work in the Palace of the Tuileries. M. Toselli having attended and performed the experiment, the Emperor expressed his perfect satisfaction as to the simplicity and efficacy of the mechanism. An ice-producing machine capable of forming 22 lbs. of ice per hour, or nearly 2 cwts. per day, is a square parallelopiped 9ft. 2in. long, 6ft. 3in. wide, and 6ft. 5in. high. It consumes four centimes (nearly a halfpennyworth) of charcoal for every kilogramme of ice formed, and only requires the attention of one man to set it at work, and to give the necessary movement to the circulation of the water. The machine costs 1801., and can be delivered two months after the order.

In our impression of the 22nd inst. the writer of this article threw out some very justifiable hints as to the delay in the awarding of the prizes of the Society of Encouragement of Paris. The evil has been remedied, and M. Dumas, having frankly acknowledged the injustice of irregular distributions of rewards, declared that henceforward they should take place at the first January meeting, and that two meetings should be held every year—one for recompenses, and another for prizes—on independent days specially reserved, and placed entirely under new conditions. Our voice has been heard, and we thank M. Dumas for his *amende honorable*. The following medals were distributed on the 20th inst.:—

Gold Medals.—Achard, for his electric break for railway carriages. The report was read by M. Tusca in his usual clear voice, and with a description so lucid that even the model (which was in the hall) was not referred to.—M. de Clermont, for hat fur procured from rabbit skins by a machine of his own invention, which shaves the hairs off and puts them in order for manufacture.—M. Paris, for his works in enamelled bronze.—Rattier, for his submarine telegraphs.—Serrin, regulator for the electro-magnetic light.—Tailbouis, sewing machine.—Wulveryck, woollen goods, white and printed.

Platinum Medals.—Bosio, clock with free escapement.—Castelnau, special instruction for public works.—Groust, economical vegetable soups.—Gillou, jun., and Thorailler, paper-stainers.—Lauth, for aniline black.—Lambotte, drawings of flowers and horticulture.—Chambon-Lacroisade, stove for heating smoothing irons.—Nauden, holosteric barometer.

F. Moigno.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, February 21.

Dr. A. W. Williamson, *F.R.S., Vice-President, in the Chair.*

The following gentlemen were duly elected Fellows of the Society, viz.:—Mr. R. H. Davey, of the War Office, Pall Mall; Mr. Jonathan Hearder, Plymouth; Mr. Henry Watson Eve, M.A., Wellington College, Wokingham; Mr. William Thurston Waite, 37, Jewry Street; Mr. Martin Henry Payne, 47, Mortimer Street, Cavendish Square; and Mr. Frederick George, of Cheltenham. The candidates proposed were—Angus Fraser, M.A. and M.D., Aberdeen; Frederick S. Barff, M.A. Cantab., 16, North Audley Street, Grosvenor Square; and Mr. Alfred Tribe, of Great Portland Street. For the second time were read the names of Major R. C. Stewart, Deputy Assistant Adjutant-General to the Forces, Horse Guards, and 12, Prince of Wales' Terrace, Kensington Palace; Mr. James Campbell Brown, 65, Bon Accord Street, Aberdeen; Mr. William Price Bonner, 69, Mark Lane; and J. Hersee Freeman, Stratford House.

The Chairman announced the Council's proposition referring to the election of officers for the year ensuing, and, agreeably to the by-laws of the Society, the names will be read at three successive ordinary meetings before proceeding to the ballot on the occasion of the anniversary meeting, March 30. The retiring officers were, the President, Dr. W. A. Miller, to be succeeded by Dr. Warren De la Rue; Dr. J. H. Gladstone, to be a Vice-President, in place of Dr. De la Rue; the ordinary members of Council who retire are Professor Debus, Dr. Letheby, Dr. Hugo Müller, and a vacancy has arisen by the death of Mr. Hadow. The names of four gentlemen proposed for election are Mr. J. L. Bell, of Newcastle; Mr. David Forbes, Dr. Matthiessen, and Professor Wanklyn.

The Chairman stated that a wish had been expressed, both in the Council and by other Fellows of the Society, to the effect that a social gathering should take place at a convenient date previous to the anniversary meeting. It had been proposed to dine together at the Albion Tavern, Aldersgate Street, on Wednesday, March 27.

A paper on "*Limited Oxidation: Determination of the Oxygen Consumed,*" was read by Mr. E. T. Chapman. The author stated that, under the influence of chromic acid, a very small amount of splitting up in the acids of the acetic series would be accompanied by a large absorption of oxygen. When, therefore, it is shown that the theoretical amount of oxygen is consumed in the conversion of an organic substance into an acid of the acetic series, it is at the same time proved that no splitting up of the acid or acids produced has taken place. It is demonstrated by quantitative experiments quoted in the paper, that in the cases of butyric ether, propione, and diethoxalic acid, the amounts of oxygen do so coincide with the calculated numbers. The determinations were made by titrating the chromic solution with oxalic acid, and weighing the liberated carbonic acid. A known quantity of this solution was then digested with a known weight of the organic body, and after the digestion the solution titrated in the same manner; the difference between the two amounts of carbonic acid is the measure of the oxygen consumed.

These determinations give the most complete control over the analyses performed by gradual oxidation. The author mentions that estimations of alchohol may be made with certainty by determining the amount of oxygen required by a given weight of the alcohol; and concludes by recommending the adoption of his process as a proved method in a great variety of quantitative examinations.

Dr. Hugo Muller inquired whether this method was applicable to the examination of members of the aromatic series.

Mr. Chapman stated, in reply, that benzoic acid resisted the action of the chromic solution as well, or nearly as well, as acetic acid. Experiments of the kind had been already made by Mr. R. H. Smith, who worked both upon the ethylic and methylic benzoate.

Dr. Odling wished to know whether, in the examination of hydrocarbons of the group C_8, any specific degree of solubility was requisite, or any particular strength of chromic solution to be employed by preference, having regard to the necessity of avoiding the breaking up of the primary molecule.

Mr. Chapman had made a few trials with amylene, β-hexylene, &c., and found the use of a strong solution with a moderate heat advantageous. It might be possible to dissolve the organic body in acetic acid, or other solvent not itself attacked, before acting upon it with the chromic solution.

Dr. Muller suggested that the expedient of first converting them into sulpho-acids might sometimes be followed. MM. Fittig and Beilstein had already treated xylol with nitric and also with chromic acid, and obtained two acid products.

Mr. Chapman said that it was important to guard against the presence of free sulphuric acid in these oxidation processes, for the least excess exerted an action on its own account.

Professor Wanklyn described the apparatus used in the laboratory of the London Institution for the heating of long glass tubes in these and similar experiments. They are laid *horizontally*, whereby an immensely increased surface of contact between two non-miscible liquids is gained, and the heat is applied by an outer steam-jacket.

The Chairman moved a vote of thanks to the author and, at an early hour, adjourned the meeting until March 7

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, February 15, 1867.

The lecture theatre of the Royal Institution was crowded on Friday evening, the 15th, to hear a discourse, by Mr. Cromwell Varley, on the Atlantic telegraph. On the table there were displayed coils of the cable successfully laid last year, and of the cable which had been picked up from a depth of two miles, having lain at the bottom of the sea for twelve months.

Mr. Varley did not enter into the consideration of the mechanical construction of the cable, nor of the plan of laying it down, but confined himself to the scientific part of the subject, and to the explanation of the difficulties which arise in attempting to transmit electric signals through great lengths of submerged insulated wire. By means of his artificial cables he demonstrated for the first time in public how the electric waves travel through. He also showed what were the limits imposed by nature to rapid signalling.

A submarine cable is a long Leyden jar whose inductive capacity depends upon the specific inductive capacity of the insulator (gutta-percha), and upon the quantity used. He explained that for a given diameter of gutta-percha core, the highest speed of signalling was attainable when the ratio of the gutta-percha was to that of the conductor as $\frac{1}{6}$. The ratio of the Atlantic cable was a little more than $\frac{3}{1}$. To double the speed of such a copper conductor, it would be necessary to apply a second covering, whose diameter was $(\frac{3}{1})^2 = 9$, and to treble it a third coat, whose diameter was $(\frac{3}{1})^3$, was required, and so on. This was expressed generally as follows:—

Thickness of dielectric in flat plates between equal conducting surfaces $= d$.

Quantity of electricity absorbed by electro-static induction $= Q$.

$$2d = \frac{Q}{2} \qquad 3d = \frac{Q}{3} \qquad nd = \frac{Q}{n}$$

Cylindrical conductors whose exterior surfaces increase with the diameter.

Thickness of dielectric $= d$.

Quantity of electricity absorbed by electro-static induction.

Ratio of exterior and interior surfaces $= r$.

$$d = Q'$$
$$d + dr = \frac{Q'}{2}$$
$$d + dr + dr^2 = \frac{Q'}{3}$$
$$d + dr + \ldots\ldots dr^{n-1} = \frac{Q'}{n}$$

and generally

$$d + dr + \ldots dr^{n-1} = d\left(\frac{r^n - 1}{r - 1}\right) = \frac{Q'}{n}$$

Light and radiant heat travel through space with a definite velocity—electricity does not. The waves of light do not flatten out or elongate during their flight over millions and millions of miles. For example, suppose the star Sirius were suddenly covered with a screen for ten minutes and then uncovered again, the star would still appear on this earth to shine continuously for about twenty years after the screen was applied, when it would suddenly be extinguished for just ten minutes and then reappear.

Electricity, in passing through a cable, begins instantly to appear at the distant end, but in strength far too weak to be measured. After the lapse of a certain time, definite for each particular cable, it begins rapidly to augment in power, and continues to approach to a definite limit of strength.

Electricity is popularly supposed to have a definite velocity, like light, but it is not so. The question, "What is the velocity of electricity?" cannot be answered without other conditions are given. For instance, it begins to arrive at the distant end instantaneously; but to reach its maximum strength would, strictly speaking, require eternity and a day, while to reach half its maximum strength would have occupied a time of $6a$—this quantity a being a definite time dependent upon the dimensions of the cable.

In 1854 Dr. Faraday gave a lecture, in which he described a number of experiments which he had made with 100 miles of gutta-percha-covered wire, and also some experiments upon 1500 miles of line between London and Manchester. But on the table before the lecturer was an artificial representation of a cable 13,000 miles in length, by the aid of which the same phenomena amplified, and many others, were exhibited.

A telegraphic cable is a long Leyden jar, one end of which is attached to the earth whilst the other is attached to a source of electricity each time a signal is to be produced. If the cable be connected to a battery for a long time, the strength of the charge in the different parts of the cable will be nothing at the end next the earth, and equal to the full power of the battery at the other end. The charges in the other parts of the cable were shown by a right-angle triangle, the diagonal line representing the potential or charge in the different parts of the cable.

The lecturer had diagrams showing the rate at which the strength of the electric currents augmented or died away at the distant end of the cable when a battery was

applied or removed from the other end. From these diagrams and experiments it was shown that to get rapid signals the receiving instrument must be very sensitive, and the moment a current begins to appear at the distant end the rest of the electric wave must be neutralised to permit a second signal to follow. This was illustrated by an artificial line equal to a cable like the Atlantic, 13,000 miles long.

This line was divided into eleven sections, and ten reflecting galvanometers were inserted at equal distances along it.

To familiarise the audience with the relative position of the galvanometers, Mr. Varley called No. 1 Gibraltar; No. 2, Malta; 3, Suez; 4, Aden; 5, Bombay: 6, Calcutta; 7, Rangoon; 8, Singapore; 9, Java; and 10, Australia.

A long telegraphic cable is a long Leyden jar of great resistance—so great that instead of electrical charges rushing in and out almost instantaneously, as is the case with ordinary Leyden jars, an appreciable time is necessary to convey a decided charge through so long a conductor to the distant end. The artificial representative consisted of eleven resistances and ten immense condensers, or Leyden jars, connected between the resistances and the earth. There was also an artificial representative of the Atlantic cable. The latter consisted of eleven resistance coils, the former of eleven glass tubes filled with water connected in series. By moving a handle the condensers could be applied to, or removed from, these junctions.

On depressing an ordinary commutator key, the cable was removed from its connexion with the earth, and a positive current allowed to flow into the line. On depressing a second key, a negative current rushed in; whilst, when both the keys were at rest, the cable was simply connected with the earth. The ten reflecting galvanometers were placed one above the other, and a bundle of rays from the electric lamp was thrown upon the ten mirrors, each of which reflected a little sun-like spot upon a large white screen, forming, when no current was passing through the cable, a straight vertical line of luminous points. On pressing the right hand, or positive key, the upper spot, which was named Gibraltar, almost immediately responded; and when it had travelled about thirteen inches over the screen, the second spot, Malta, began visibly to move, the third Spot, Suez, following later still. It was, however, fifteen or sixteen seconds before any decided motion or current was noticed at the Australian end of the line. After the lapse of a minute, a powerful current was rushing out at the Australian end. The English end was then removed from the battery, and connected with the earth, and quickly after the Gibraltar spot rushed across to the other side of the screen, indicating the rushing back of a powerful current to the earth. This was followed shortly afterwards by Malta, Suez, and Aden. Bombay came only as far as the zero line. The currents in the different parts of the cable were flowing out at each end, leaving Bombay neutral. It was some minutes before the cable discharged itself sufficiently to allow the ten spots to come near enough to the zero line to admit of a second experiment.

When a succession of signals was sent into the cable by alternately depressing and elevating the key, for periods of five seconds each, these impulses produced waves which could be distinctly traced as far as Aden, where their individuality became lost. The little spots beyond this station showed the presence of a current resulting from the combination of these successive waves. Mr. Varley then pointed out the methods of clearing the line after each impulse. In 1853-54 he invented a plan which consisted of sending after each positive current a negative current—a plan which is now generally used in working submarine lines, except the Atlantic.

In 1856 he invented a plan which consisted of sending a strong positive current of definite duration into the line, followed by a weak positive current to produce a signal, this being followed by a strong negative current, succeeded by a weak negative current to clear the line. This system was a great improvement upon the former.

In 1858 Professor Sir William Thomson proposed the use of three currents of equal duration but irregular strength and alternate signs, which produced a still more rapid result.

In 1863-64 Mr. Varley found, by experiments on his artificial line, that by using a succession of four or five currents, all of the same strength but varying in duration, greater rapidity could be secured. For example, first a positive current, followed by a negative of longer duration, followed again by a positive current of much less duration, then a shorter negative current, and that again by a very short positive current, produced a succession of positive and negative waves throughout the line; the result of all of which was at the Australian end one very small positive wave, perfectly distinct, the rest of the line being left almost immediately entirely free from all traces of electricity, ready for the instant production of a second signal.

The lecturer roughly calculated the proper duration of the currents by the aid of a watch, and the luminous diagram showed how the line was filled with a succession of positive and negative waves, each of which quickly neutralised its neighbours.

This operation of discharging has been expedited to such an extent by means of the instrument known as the "curb key," that the great wave can be arrested at the distant end of the cable before it has arrived at $\frac{1}{200}$ of its proper height, and the line left clear for another signal almost immediately after. This was illustrated by the Australian line.

When the condensers were removed from the line—which was equivalent to lifting the cable out of the ocean—the ten stations gave simultaneous and apparently instantaneous electric indications.

This was very prettily illustrated on the artificial Atlantic cable, by placing a Geisler's vacuum tube in the place of a telegraph instrument at the "Newfoundland" end of the line.

This tube was found by experiment to resist the passage of an electrical current until its strength amounted to somewhere between 390 and 400 Daniell's cells. A battery of 800 Daniell's cells was connected with the cable, after which several seconds elapsed before any indication of its having reached Newfoundland was visible in the Geisler's tube; but as soon as the power at that end amounted to half the power of the battery at the English end, a beautiful violet flame was seen illuminating the tube.

The English end was then suddenly connected with the earth through a second Geisler's tube, when both tubes were seen shining brilliantly at first, but gradually declining as the charge in the cable decreased.

The Newfoundland end of the cable was the first to go out, and the English end continued to shine for a second or two after, because the potential of that end, when first connected with the Geisler's tube, was greater than that of the Newfoundland end, because it was nearest to the battery. The moment the condensers were removed, the speed was instantaneous. When the condensers were charged with the 800 cells, and discharged through a piece of tinfoil, a brilliant splash, a loud report, and a hole in the tinfoil half an inch in diameter was the result.

The lecturer then showed his invention for preventing the disturbance arising from earth currents, and for expediting the signals through the cable, which did not record the strength of the current, but "the rate of increment and decrement of potential."

He placed a reflecting galvanometer between the distant or "Newfoundland" end of the cable and the earth (this being the usual mode of connecting telegraph instruments), and also a second one with a "condenser" between it and

the earth. At the English end there was an apparatus which produced currents through the cable similar to those produced on telegraph circuits by the Aurora Borealis and other causes. These experiments were very conclusive; the slow but large wave of the earth current was seen to produce scarcely any action upon the galvanometer with the condenser, while the ordinary one was seen running 20 feet on either side of the scale, in consequence of the earth currents.

The small waves on the back of the great swell of the earth currents were, however, perfectly disentangled, by this simple contrivance, from the great slow-rising wave, and the signals were perfectly legible on the one instrument while illegible on the other, whose image ran wildly over the wall of the Institution. In addition the signals were transmitted more rapidly and clearly by this arrangement.

In concluding, Mr. Varley remarked that it was upon the data furnished by this artificial cable that he had designed the present Atlantic cables, and that without it he could not then have guaranteed eight words a minute without a core whose conductor and insulator were each 60 per cent. greater than the present, which consisted of 300 lbs. of copper and 400 lbs. of gutta-percha to the mile; and he added that it was at least some reward for the years of arduous labour he had had in connexion with this great enterprise, to find that everything he had predicted as to the capabilities of the cables had been entirely verified.

SOCIETY OF ARTS.

On the Synthesis and Production of Organic Substances and the Application which some of them receive in Manufactures, by Dr. F. Crace Calvert, *F.R.S., F.C.S., &c.*

Lecture II.

On the Transformation of Neutral Substances.

The object in this evening's discourse is to invite you to examine with me the valuable, varied, and curious transformations which one substance is capable of undergoing, and which have been brought out through the study of its chemical nature and composition; and what, I hope, will render these transformations especially attractive is the fact, that they have reference to the reproduction of substances which are either found abundantly in nature, or which have received numerous and useful applications in arts and manufactures. The substance which I refer to is starch, a white, granulated substance, insoluble in water, which undergoes no change or decay, if kept dry, even for centuries, but which, when damp or brought into contact with water, rapidly undergoes decay. Starch, when boiled for a few minutes with eight or ten parts of water, and the whole allowed to cool, forms a jelly, which gives a magnificent blue colour with iodine. This colour has been the subject of much study by chemists, owing to the fact that it disappears when heat is applied to it, and that it reappears as the liquor cools. It is so brilliant that many attempts have been made to apply it in some form or other in arts and manufactures; and in some of my previous lectures I have described some of them. Starch, as you are aware, is most abundantly found in nature, especially in the grains of cereals, such as wheat, barley, oats, &c.; it exists also in large quantities in bulbs, such as potatoes; and in leaves, fruit, stems, and roots. It is easy to conceive that such a substance should have been devised by the Creator, first to preserve and then to feed the young germs contained in seeds; for, as I have just stated, it is unalterable by time if kept in a dry condition, whilst it undergoes the most rapid transformations if placed under certain circumstances, or if it comes in contact with certain chemical agents. Of this we shall have, as we proceed, most interesting instances, especially when we examine the transformations which starch undergoes during the germination of seeds and in the ripening of fruits; but, to enable you to understand thoroughly these transformations, allow me to call your attention to some of the transformations which starch undergoes by purely chemical action, and then we shall apply them with better success to the chemical changes which take place in nature under vital action.

When starch is mixed with hot water, and a few thousandths of an acid, especially vitriol, are added, the globules of the starch are swollen; they burst; and the more soluble portions of the amylaceous matter are transformed into what is called soluble starch, the liquor losing its opaque appearance and becoming transparent. I may mention that it is a similar transformation that renders the Glenfield patent starch so much appreciated for stiffening net and other similar fabrics, owing to the circumstance that they are stiffened without becoming opaque. Let us now proceed to examine what takes place if the proportion of acid is slightly increased, and the heat continued for a short time; we shall find that the starch is susceptible of undergoing a further molecular change, the liquor assuming a slight yellow tinge, and instead of giving with iodine a bright blue colour it yields a rich crimson, the starch having become converted into what chemists called dextrin. This transformation is purely molecular; nothing is added to or subtracted from the original elements of the starch. But if, instead of stopping the operation at this point, we still continue to boil for, say, three or four hours, we shall find that the liquor will gradually cease to yield a colour with iodine, and when it has entirely ceased to do so, if we neutralise the slight acidity of the liquor by adding to it a little chalk, and by filtration remove the gypsum deposit, we shall observe that the liquor has a decided sweet taste, and that we have transformed the starch into glucose, or what is often called grape-sugar because it is found in grapes, fruit-sugar because it is found in most fruits, diabetes-sugar because it is found in diabetes. This interesting transformation of starch into sugar is carried on, on the Continent, on a most extensive scale, thousands of tons of glucose being manufactured annually, which are used by brewers as a means of producing a cheap and frothy beer; and allow me to add, "under the rose," that it is also employed—and that not with advantage to the consumer—to adulterate honey. In England glucose is not manufactured, in consequence of the restrictions imposed on it by Government and the excise laws, but I must not forget to state that when the transformation of starch into glucose is effected on a commercial scale, the apparatus employed is such as to enable the manufacturer to use a slight pressure, experience having demonstrated that this transformation is much more rapid under the influence of a slight increase of pressure, and therefore the manufacturer avails himself of it. You will remember, no doubt, that in several of my previous lectures I have drawn your attention to the fact, that many chemical transformations are brought about or facilitated by an increase of pressure, easily obtained when the mass acted upon is confined in vessels so constructed as to prevent the vapours from escaping.

The transformation of starch into dextrin is also effected by other means. Thus, if it is submitted to the action of a heat of about 400°, it undergoes the same isomeric change, and is converted into dextrin; this transformation is most important, and is carried on, on a most extensive scale, in Lancashire and the north of England, a cheap substitute for gum-arabic being thus placed in the hands of calico printers to thicken their colours, and to enable the workman to apply them on the surface of fabrics, either by means of rollers or engraved blocks. As the orange-yellow colour assumed by wheaten starch and potato farina under the influence of heat is often objectionable in a practical point of view, manufacturers mix the wheaten starch, or the farina, with a small quantity of

acid, and, after having dried the whole, submit the mass to a comparatively low temperature, when the transformation of insoluble starch is effected, and soluble dextrin, nearly colourless, or patent gums, as they are called, are produced. For more technical details I must refer you to a paper which I had the honour of reading on the subject a few years since before this Society.*

It is scarcely necessary that I should state that starch is converted into dextrin and then into sugar under the influence of peculiar ferments. You will, I am sure, remember that I explained these transformations when speaking of the action of the saliva, and also that of the pancreatic glands, in my lectures on animal physiology last year. You are also, I know, perfectly aware that it is a similar transformation which takes place in the brewer's vat under the influence of the albuminous ferment called diastase, when malt is converted into the saccharine fluid which is called "wash," and which is ultimately converted, by boiling with hops and fermentation, into that national fluid called beer or ale. With these facts before us we can not only appreciate the value of starch in seeds, plants, and fruits, but follow with interest the changes which it undergoes in order to become useful in the germination of the young plant, or in the ripening and sweetening of fruits. Most seeds—indeed, I may say, all seeds—contain essentially two elements, one called starch and the other albumen, a substance, as you are aware, which in the animal kingdom characterises the white of egg and the serum of blood. When a seed is placed in moist soil, and a gentle heat surrounds the whole, the albumen undergoes a molecular modification, and becomes a ferment, which differs from common albumen by the fact that it requires a much higher temperature to coagulate it. Under the influence of this ferment and the joint action of heat and the moisture which surrounds the seed, the starch is converted first into dextrin, and then into sugar—or, in other words, into such substances as are soluble, susceptible of being absorbed, fixed, and transformed into such elements as will constitute the tissues of the young plant. I shall have the pleasure of showing you, as we proceed with this lecture, that when one chemical equivalent of starch has fixed two equivalents of water, and has thus been converted into sugar, it can unfold itself with great facility into either three equivalents of acetic acid or two equivalents of lactic acid, as shown by the following table :—

Sugar	$C_{12}H_{12}O_{12}$
Acetic acid, three equivalents .	$C_4H_4O_4$
Lactic acid, two equivalents .	$C_6H_6O_6$

These acids, or similar ones, dissolve the lime and other mineral matters surrounding the seed, thus carrying to the young germ those mineral elements which it required to become a young plant, which, when once it has grown out of the seed and of the soil which surrounds it, puts forth leaves, which are susceptible of absorbing the carbonic acid of the atmosphere, thus fixing its carbon, which constitutes the framework of the young plants. This carbon, united with the elements of water and nitrogen, gives rise to all the vegetable substances necessary to constitute the vegetable matter of full-grown plants.

The ripening and the sweetness of fruits are due to the conversion of starch into sugar; but although this conversion is effected by the presence of acids in the fruit, still they are not exactly the same as those which exist in the young seed, and therefore this peculiar transformation of starch into sugar in fruits deserves our special notice. The predominant acid in green fruit is called malic acid, which partly disappears as the fruit proceeds towards its maturation, whilst the greater part unites with the sugar it has helped to produce.

In fruits and in bulbs there exists another substance which presents to us a peculiar interest. It is a white, gelatinous mass, insoluble in water, and is called pectose. It is also accompanied in fruits and bulbs by its ferment, called pectase, the same as starch is accompanied by its ferment, called diastase. As time proceeds, the pectase acts upon the pectose, and converts the insoluble substance pectose into the soluble substance called pectine, which is a neutral substance, but which in its turn is converted into an acid called pectic acid. This acid, in connexion with malic acid, sometimes converts the starch contained in fruit into sucrose, or cane sugar, fructose, or fruit sugar, which I may here state differs from cane sugar in not crystallising with the same freedom, is not so sweet, and also contains two chemical equivalents more of water. The transformations of pectose into pectine and pectic acid are isomeric changes, and therefore are most easily effected in nature. The following table will clearly demonstrate the truth of this assertion :—

Pectose	$C_{64}H_{40}O_{56},8HO$
Pectine . . .	$C_{64}H_{40}O_{56},8HO$
Pectic acid . .	$C_{64}H_{40}O_{56},4HO$
Metapectic acid. .	$C_{64}H_{40}O_{56},16HO$

(To be continued.)

* See *Journal*, vol. viii. p. 87.

ACADEMY OF SCIENCES.

February 18, 1867.

(From our own Correspondent.)

The news of the death of Madame Pelouze, which took place almost suddenly in the night of the 17th-18th inst., spread a gloom over the proceedings of the Academy in the Hall of Sciences, where the illustrious chemist possessed as many friends as professional brethren. Each feels that he loses the most excellent of companions, and takes a lively part in the general grief.

An amateur astronomer has recalculated the elements of the comet recently discovered at Marseilles, and finds some resemblance between it and the comet of 1771.

The Baron de l'Epine gave some details on the ossiferous beds discovered by him in the grottoes or caverns above the Lac de Bourget, in Savoy. He found there human bones and those of carnivorous animals, fragments of bricks similar to those which enter into the construction of the Roman hot baths of Aix, which date as far back as the second century of our era.

M. Henri Sainte-Claire Deville analysed in a few words a new note on the density of vapours. It refers to the chlorides of niobium and tantalum; and the results obtained by the celebrated chemist agree in every respect with those of M. Marignac, of Geneva.

M. Dumas presented the hydrological map of the department of the Seine, very carefully got up by M. Delisle, engineer of mines. A great innovation is, that M. Delisle gives at every five metres the depth at which, by sinking a well or boring, one is sure to find water; it is an immense service rendered to proprietors and manufacturers.

M. Combes, Director of the Imperial School of Mines, presented to the Academy a book which he has just published, through Bouchard-Huzard, under the title of "Essay on the Mechanical Principles of Heat, and of its Practical Applications." "My aim," said the author, "is to popularise among engineers and constructors of machines a theory to which they cannot remain much longer strangers, and which should, in fine, pass into the instruction of our schools. Consecrated, at the present day, by its accordance with phenomena observed since it has been established, as well as with facts anciently known, of which it alone furnishes a sufficient explanation, it brings to light the enormous losses of heat which take place in our steam engines, even the most improved, shows the progress which remains to be made, assigns its limits, and will lead, no doubt, to its realisation. . . I have, above all, had a view, in the editions of this work, to simplicity and clearness. I confine myself to the exposing the general

principles, the facts which appear at present definitively established in science, and the practical consequences which follow therefrom.

M. Davanne sent his photographic annual for 1867, published by M. Gauthier-Villars. It is an excellent little volume, which contains, in a convenient form, a mass of useful information, which photographers and chemists will with difficulty find elsewhere. Printed upon strongly sized paper, it will bear all observations to be written in ink; and a few blank pages left expressly in the formulary are very convenient to receive any modifications that practice may suggest. The first portion gives the general state of the photographic world, societies, sciences, meetings, recompenses, patents, publications, and journals. In the second part, the author gives a comparative essay upon the most brilliant facts and the important progress which have taken place during the preceding year, with indications of the sources from which they have been obtained. The third part comprises a general formulary for the wet and dry negative processes, with tables very useful to the photographer desirous of making his own preparations or of verifying the products.

Thus we perceive that this *séance* has been a very poor one; let us enliven it a little. In quitting it, we thought proper to reproach M. Fremy for having preserved for silicic acid the formula SiO_3. We said to him, "You are quite aware that with the numbers of molecules of silicium and oxygen given by this formula, it is absolutely impossible to constitute a molecule of silicic acid. You know that M. Marignac, of Geneva, Henry Rose, and others, have concluded, from very long researches, that the only possible formula is SiO_2." "This may be true, perhaps, and it is true; *but it is so inconvenient to change old habits.*" Nothing is, in fact, more convenient than error; nothing is often more austere than the truth. This is how routine goes on perpetuating errors, barring the access to true progress, even in the less exact sciences. How many thousands of chemical formulæ are more impossible than that of silicic acid; and how many thousands of errors proceed from the inkstands of chemists!

We learnt yesterday that the Lalande medal has been awarded by the Section of Astronomy to the Astronomer-Royal of the East Indies, M. Maclear, for the great work of triangulation, and the measurement of a meridian, that he has published.

We are now at the 19th February, and the Academy of Sciences has not yet held its annual public meeting for the distribution of prizes, which, according to the regulations, should take place, at the latest, in December. How does it happen that the learned bodies in France are so negligent?

NOTICES OF BOOKS.

A New Chemical Nomenclature. By S. D. Tillman. Albany (U.S.): C. Van Benthuysen and Sons. 1866.

We will try, as briefly as may be, to give an outline of the proposed scheme, but to understand it thoroughly the whole of Mr. Tillman's pamphlet should be carefully read. To quote from the context, the first words are, "The present seems very opportune for the introduction of a nomenclature which will more completely methodise the science of chemistry." "The nomenclature now presented is the result of an attempt to obviate the continual embarrassment attending the prosecution of chemical studies," and so the writer resorted to mnemonical methods. The present time is by far the best for the change, for "the meaning of the new notation being *definitely* fixed, while the nomenclature may be said to be still in the transition state, an atomic system of names, intended to supply the place *both of the notation and the old nomenclature*, is submitted for candid and critical examination." "This work was accomplished in a *true conservative* spirit, by building the new structure from old materials." The system is based on abbreviations of the universally received names of the chemical elements and symbols, with modifications found to be necessary. "The name of each chemical element given, not to its mass but to a minimum combining proportion called an atom. Thus the atom becomes the unit of measurement, and starting-point of the scale in each series of compounds." The atomic name of each *metal* consists of two syllables and ends with an m, but each "*metalloid's*" name terminates with a different consonant. In passing we must remark that Mr. Tillman uses the expressions "metalloid and atomoid." Thus the terminal consonant of fluorine is F, of bromine B, and of sulphur S, &c. The number of atoms of any element in a compound body is designated by the vowel immediately preceding its terminal consonant; the numerical value of the vowel advances with the alphabetical order: thus, A to U expresses 1 to 5, 5 to 10 by the same vowel with the full sound. For example, the iron in ferrous oxide is expressed as ferr-a-m, that in ferric oxide as ferr-e-m, F_5 = ferr-u-m, Fe_6 = ferr-ea-m (ā), Fe_7 = ferr-ee-m, Fe_8 = ferr-ei-m, Fe_9 = ferr-eo-m, Fe_{10} = ferr-eu-m. The long values of the vowels are taken for numbers above 10; thus, au = 16 (6 + 10) and oo = 18 (9 + 9). X is used with a vowel preceding it as an exponent, giving a progression; so 10 = ax, 20 = ex, 70 = eex, 80 = eix. Qu expresses the hundreds to, and including, 1000, by prefixing and suffixing. Thus, Mr. Tillman expresses 1080 by euqueix. We have shown how the metals are named, and the various atoms combining expressed, by this system, so we presume that an alloy of 1080 parts of zinc to 930 parts of copper would be zinceuqueixm-cupreoquixm; of course a more simple ratio exists in this case—*i.e.*, 108 : 93—but in a complex alloy such simplicity of ratio could not be attained. The non-metallic elements are named thus, fluoraf or af, sulp-a-s or as, phosph-a-p or ap. If the symbolic letter cannot be used, as the H in hydrogen (so getting hydrate), l is used to denote the lightest of substances, and d the densest, getting H = hydral or al, Cl = chlorad or ad, I being volatile, producing violet vapour, dav or av; oxygen is oxat, being the name of a single *atom*, or "the atom *par excellence*." An atom of selenium is selaz; it bears a strong resemblance to sulphas or as, expressed by similar sounds as, az.

These examples will suffice to show the author's drift. An additional character is used for each of the compounds of carbon and hydrogen. One example will suffice to show the most plausible use of this nomenclature.

3. The chromium atom, properly chromam, may be contracted to chram, which is especially convenient in denoting chromates.

Protoxide of chromium (chromous oxide), chramat.

Magnetic oxide of chromium (chromoso-chromic oxide), Cr_3O_4 = Chr-i-m-o-t.

Sesquioxide of chromium (chromic oxide), Cr_2O_3 = Chr-e-m-i-t.

Monochromate of sesquioxide of chromium, Cr_3O_6 = Chrimeat.

Bichromate of sesquioxide of chromium, Cr_4O_9 = Chromeot.

Neutral chromate of sesquioxide of chromium, Cr_5O_{12} = Chrumoit.

Acid chromate of sesquioxide of chromium, Cr_6O_{15} = Chreamyut.

Chromic acid, CrO_3 = Chramit.

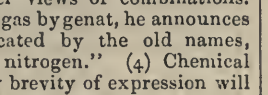
The author calls the residue of a molecule a torso; he thus writes phosphil, apt‴, from its atomicity being equal to the difference between the normal saturating power of its components; so hydroxyl H′O″ = alt′. Theoretically considering butyl as $(CH''_2\ CH''_2\ CH'_2\ CH'_2)$ + H, it becomes ochal′; ochet being butylic acid, acetic acid is achet, and amylic uchet, rutilic being euchet. "Apparent abnormal action, for instance, in the case

of I_2O_7, &c., may be accounted for by supposing an even number of atoms of oxygen, O_6, in alternately opposite polar conditions, to be united with I_2O." Great are the powers of theory! and certainly the applications of Kekulé's new views are almost limitless; for we are told that, in the case of the hydride of copper, cupramal, *a dyad metal plays the part of a monad.* It will supply a want of the mineralogist; for by this method Fe_3S_4, a magnetic iron pyrites with no systemic name, becomes on direct principles ferrimos, and another unnamed variety, Fe_7S_8, is ferreemeis. The author's enthusiasm, however, carries him a little too far. It may be all very well to write down bihydrochlorate of bibromoterchloronaphthaline ($C_{10}H_3Br_2Cl_3HCl$), or for $HIg_4H_4Cl_2N_2O_2$ tetramercuriotetrahydric-dioxidichlorodinitride; and the proposed substitutions hygomoledent and eurulebod are certainly shorter; but, if the composition is known to him, a practical chemist would express the formula at once, and so give more precise information with infinitely less effort; and there certainly would be no need for bearing any such name in mind. Equations also are abolished. "Williamson's original view of the constitution of ethers is expressed by the following:—Sodam-echalt with echal yields sodama and echalemat." The author gives the following reasons for the adoption of this scheme:—(1) It would be the chemist's shorthand—for example, CO_2 is pronounced with three syllables, and garet (*i.e.*, CO_2) with two, &c. (2) Chemical equations will be abolished, objected to on principle by some chemists. (3) Its use in conversation would soon correct many vulgar errors, and inculcate, by mere imitation and habit, clearer views of combinations. "When one designates laughing-gas by genat, he announces at once several facts not indicated by the old names, nitrous oxide or protoxide of nitrogen." (4) Chemical writers who are obliged to study brevity of expression will appreciate the saving of pen- and type-work by its use—*e.g.*, announcement of a late scientific achievement:—

Lossen has succeeded in replacing [an atom of hydrogen in ammonia by an atom of hydrogen and oxygen or hydroxyl; thus forming hydroxalamine].

Lossen has succeeded in replacing [al in ilan by alt; thus forming altelan].

Type.



It is, indeed, proper to say that the author has proved "the copiousness and capacity" of the new scheme, and we owe it to him in the barest justice to say that the scheme as a mnemonic scheme appears perfect; and that it is not more complex than such a scheme of necessity must be. The work has had bestowed upon it the greatest labour, thought, and knowledge; and, whether it be adopted or not, the thanks of the chemical world are due to Mr. Tillman, whatever its verdict may be, for giving them the opportunity of forming a correct judgment on the feasibility of any such scheme. But for our parts we think that although our ears might in time get accustomed to the seeming strangeness of the terms and their want of resemblance to anything to which we have been in the habit of attaching ideas—or, to go further, if in all future books the new name were added in italics, in lieu of the ordinary symbols which now involve the use of figures not often read easily, with the old name of the body—objections to its adoption would remain still. In the first place it is founded on shifting theories—*i.e.*, of complex organic nomenclature. 2nd. The tendencies of theoretical chemistry are in a totally different direction—to a mathematical, not mnemonic, expression of facts. 3rd. The chemistry of the old authors would be more than ever unavailable. 4th. The present rooted stage of chemistry will not allow a total revolution. 5th. A universal adoption, all but unattainable, is absolutely necessary for its success. 6th. Chemists would not only have to learn something fresh, but also unlearn all that they know, in as far as words express facts, not the facts themselves. 7th. It is, as the author states, a shorthand, and we should immediately have A.'s, B.'s, and C.'s systems also. Any one of these objections is in itself fatal to any scheme of the kind. We would also remind Mr. Tillman of what he says in allusion to the present changes in nomenclature now gaining ground. "No sweeping innovation which changes or perverts the meaning of old terms, rendering old and familiar works on chemistry comparatively worthless, and which tends to eradicate fundamental ideas, will be accepted by the present generation;" neither do we think it will be by any future generation.

NOTICES OF PATENTS.

1446. *Composition for Beautifying the Complexion.* J. Lewenberg, Upper Berkeley Street, Portman Square, London. (Not proceeded with.) Dated May 23, 1866.

The composition consists of—Pulverised egg-shells, one pound; calcined magnesia, two ounces; terra alba, one pound; marsh-mallow root, one pound; orris root, one pound; gum benzoin, half an ounce; rose-water, one pint; otto of rose, five drops; cascarilla root, quarter of an ounce. The proportions may be varied. A complexion beautified with the above concoction would be an interesting subject for exhibition at some scientific society.

1495. *Composition for Removing Incrustations and Preventing the Formation of the same in Steam-boilers.* G. Haseltine, Southampton Buildings, Chancery Lane, London. A communication. (Not proceeded with.) Dated May 29, 1866.

This is a mixture of baryta, sal ammoniac, sugar, and lye, which is to be added to the water in the boiler, when it not only prevents incrustation forming, but removes any that may already be there, and so considerably diminishes the risk of explosions. We confess we do not see the mode of action of this mixture.

1615. *The Purifying of Ammoniacal Liquor by an Improved Process, and the Application of such Purified Ammoniacal Liquor to the Purifying of Coal Gas.* G. D. Malam, Halifax, Yorkshire. (Not proceeded with.) Dated June 14, 1866.

This invention consists in the use of a "desulphurating scrubber," open at the top and partly filled with coke, into which a stream of ammoniacal liquid is caused to flow through a rose, and is met near the bottom by a strong current of air, which effectually desulphurates it. When coal gas is passed through the resulting liquid, the sulphuretted hydrogen and sulphur compounds are effectually removed.

1646. *Mode of Transmitting Messages by the Electric or Magnetic Telegraph.* F. J. Bolton, Bruton-street, London. Dated June 19, 1866.

This relates to the employment of a tabulated code of signals in telegraphy. Words and letters are expressed by groups of figures, which are telegraphed, as in the Morse system, by dots and dashes. The advantages claimed are a greater speed of transmission and less liability to error.

1628. *Method of Treating Permanent Inflammable Gases, whereby greater Heat is obtained therefrom.* B. F. Stevens, Henrietta Street, Covent Garden, London. A communication. Dated June 15, 1866.

In this invention steam is mixed with the gas just before burning, by which, it is stated, a much greater heat may be obtained.

1639. *Manufacture of Pigments.* J. E. T. Woods, Camberwell Grove, Surrey. Dated June 18, 1866.

This is a plan for utilising the lead deposited from lead

furnaces by treating it with common salt. A chloride of lead is thus formed which is suitable for making white pigments.

1707. *Preserving Animal Substances.* H. Medlock. Tavistock Square, London, and W. Bailey, Wolverhampton. Dated June 27, 1866.

This invention relates to the preservation of various animal substances by means of a solution of bisulphite of lime and gelatine, or bisulphite of lime and common salt.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

231. J. Greenshields, Glasgow, N.B., "An improved compound or combination of materials to be used for the production of illuminating gas."

241. C. E. Brooman, Fleet Street, "Improvements in the manufacture of soap." A communication from A. Phillipe and G. Forlier, Lyons, France.—Petition recorded January 29, 1867.

3232. T. Gray, Wandsworth, Surrey, "Improvements in the preparation of bleaching materials or compounds."—Dec. 7, 1866.

3300. E. Meldrum, Bathgate, Linlithgow, N. B., "Improvements in the manufacture of gas for illuminating and heating purposes."—Dec. 15, 1866.

242. E. de Nève, St. Mary-at-Hill, London, "Improvements in producing certain colours from aniline and coal tar."—Jan. 29, 1867.

Notices to Proceed.

2540. W. Hope and H. Browning, West Drayton, Middlesex, "An improved composition to be substituted for ordinary paints."—Petition recorded October 3, 1866.

2536. C. E. Brooman, Fleet Street, "The production and application of an imponderable fluid, together with the apparatus or means employed therein." A communication from M. Ziegler, Paris.

2696. G. W. Shinner, Strand, Middlesex, "Improvements in the means of, and apparatus for, utilising sewage matters and liquids."

2607. T. Outram, Grutland, near Halifax, Yorkshire, "Improvements in the manufacture of cast iron."—October 9, 1866.

2656. J. Dale and J. G. Dale, Manchester, "Improvement in sulphuring yarns and fabrics."—October 13, 1866.

2669. G. T. Bousfield, Loughborough-park, Brixton, Surrey, "Improvements in the manufacture of green and blue colouring matters." A communication from A. Poirrier and C. Chappat, jun., Rue d'Hauteville, Paris.

2671. A Swan, Kirkaldy, Fifeshire, "Improvements in, and in apparatus for, evaporating or recovering lees."—October 16, 1866.

2681. J. Slessor, Glasgow, N.B., "Improvements in distilling alcoholic spirits."

2683. J. Hamilton, Glasgow, N.B., "A new and improved fuel."

2686. C. A. Girard, Rue des Ecoles, Paris, "Improvements in the manufacture of blue colouring matter." Partly a communication from G. de Laire, Rue de Sèvres, Paris.—October 17, 1866.

2745. H. D. Plimsoll, Great Ormond-street, Middlesex, J. B. Davies, Gresham-street, London, and W. R. Dawson, Homerton, Middlesex, "Improvements in extracting metals from titaniferous iron, sand, or minerals containing metals."—October 24, 1866.

2756. H. Phillips, Clyst, Honiton, Exeter, "Improvements in the preparation of deodorising materials, and in the manufacture of gas."—October 25, 1866.

2773. J. Wagener, Wellclose-square, Middlesex, and G. J. Firmin, Millwall, Middlesex, "Improvements in sugar refining."—October 26, 1866.

3269. J. Baggs, High Holborn, Middlesex, "Improvements in the manufacture and treatment of hydrochloric and nitric acids."—December 13, 1866.

128. B. Lieton, Rue de Houblon, Brussels, "An improved composition to be employed in welding or soldering iron upon iron, steel upon steel, and iron upon steel."—January 18, 1867.

CORRESPONDENCE.

Standard Thermometers.

To the Editor of the Chemical News.

Sir,—Having had standard thermometers verified both at Kew and also by Mr. Glaisher, I can confidently assert that the difference between the zeros given in the two cases is very small indeed. The zero points of all thermometers, as a rule, rise in a month or so after the instruments are made. This rise varies generally between ½° and 2°. The bulbs of the best thermometers should be blown some months before the instruments are pointed. In this manner the greater part of the error may be avoided. Even after all due precautions have been taken, the thermometer should be either compared from time to time with another standard which has been repeatedly checked, or, when this cannot be done, its zero should be independently tested by means of melting ice. If boiling water should be used, the height of the barometer must be observed, and the influence of the atmospheric pressure taken into account. The use of boiling water is objectionable for the purpose of testing, as it has a tendency to permanently raise the zero of the instrument, even if it has been unchanged and correct before immersion. Those who possess old thermometers should ascertain their errors and then be careful of them, as from what has just been stated it follows that they will not be nearly so liable to further changes of their zeros as newly made instruments.

I am, &c. John Browning.

111, Minories.

To the Editor of the Chemical News.

Sir,—"A Subscriber" communicates in your last number an explanation by Mr. Pastorelli of the seemingly strange difference between a thermometer certified at Kew and another certified by Mr. Glaisher. It was not necessary, perhaps, to be at the trouble of consulting a manufacturer, as the right explanation is given in all good treatises on natural philosophy, and as it ought to be known to every one concerned with accurate thermometrical measurements, that newly made thermometers must not be graduated at once, owing to the slow contraction of the glass after having been exposed to the boiling heat of mercury. The most likely cause of the after-contraction is the one-sided pressure of the air. The bulb does not acquire, on cooling, its original size for some months. It is a universal practice with good scientific instrument-makers in Germany to keep their thermometers, after having made the mercury boil and sealed the tubes, for a whole twelvemonth before graduating them. Mr. Pastorelli explains the after-contraction of the glass by some circumstance in the manufacture, but this does not go to the root of the thing, because ever so long after the tubes have been manufactured and the bulbs blown, the after-contraction will appear whenever the instruments have been heated to the boiling point of mercury. Accordingly, every thermometer loses its accuracy for many months whenever it has served for the determination of higher temperatures, and there are very few thermometers in use in chemical laboratories that do not come under this head. An instrument, after adjustment, can only once be used for accurate determination of boiling points without readjustment, a circumstance very often lost sight of in chemical researches, and which explains, no doubt, many discrepancies between statements of different authors.

I am, &c. G. L.

South Shields.

Paper from Wood.

To the Editor of the Chemical News.

Sir,—In this last week's "Chemical News" I see a paragraph on how "To Recognise Wood-fibre in Paper," which speaks about "suspected" paper, as if wood-fibre was looked upon as an adulterator, as if it was illicit and added for the purpose of adulteration. Can you inform me if it is so? I hope not. I know a great deal of interest and trouble have been taken with it in this district, and that no small feeling of pride has been expressed at us being the first to start a factory for the production of wood-pulp for the fabrication of paper. The gentlemen composing the Company of Wood-pulp Manufacturers are the last to do a dishonourable act, and in their successful experiment to make pulp from old pit props into a state ready for the paper manufacturer, they were solely encouraged by their love of science and ambition to make paper from an abundant material in place of a scarce one. Had they any idea that they were acting dishonourably, nothing would give greater pain. The wood-pulp makes a capital brown paper for packing casks, &c.; in its fabrication it has rather too much water in it to be easily worked.

I am, &c. Inquirer.

[The word "suspected" was not employed in the sense in which "Inquirer" has taken it; nothing dishonourable was implied in the use of the word.—Ed. C. N.]

Discovery of Coal Gas.

To the Editor of the Chemical News.

Sir,—The following fact seems worthy of record, and may perhaps be a sufficient answer to the inquiry of "Rusticus" (page 72), "Who was the real discoverer of coal gas and its properties?"

The late Dr. Joseph Skey, who died a few months ago at a great age, told me a short time before his death, that he attended Dr. Priestley's chemical lectures in the New College at Hackney about the year 1793, and that, besides directing the attention of his class to the jets of inflammable gas sometimes produced in a coal fire, Dr. Priestley put some comminuted coal into the bowl of a tobacco-pipe, which he closed with clay, and, having put the bowl into a fire and produced a jet of gas, which he ignited, remarked to the class, "Now, gentlemen, I have no doubt that this will some time be turned to an important purpose." Dr. Skey said that he had the most clear remembrance possible of these circumstances.

Dr. Thomas Thomson, in his biographical account of Priestley ("Annals of Philosophy," i. p. 92, London, 1813), does not mention coal gas among the gaseous bodies produced and investigated by him. I am, &c.

James Yates.

Lauderdale House, Highgate, February 23.

Ozone.

To the Editor of the Chemical News.

Sir,—During the month of January, judging from the ozone tests, there were periods of ozone from the afternoon of the 5th to the 9th, and from the 20th to the 31st; periods of little or no ozone from the 1st to the morning of the 5th, and from the 10th to the 19th.

The period of ozone which commenced on the 20th of January still continues. Large quantities of ozone were present on the 7th, 23rd, 24th, 28th, 29th, and 31st; scarcely a trace on the 4th, 13th, 14th, and 18th.

I am, &c. R. C. C. L.

Sea Grove House, Bournemouth.

[Probably many of the discrepancies in the registration of ozone are due to the defective methods generally adopted. It would be doing good service if some experimentalist would devote attention to the improvement of the ordinary ozone papers, or to their replacement by some more trustworthy test.—Ed. *C. N.*]

Adulterated Gypsum.—German Yeast.

To the Editor of the Chemical News.

Sir,—Knowing gypsum to have been used extensively as a "drier" for manure, and also as a manure itself, perhaps it may be of service to those who use it to know that it often contains sulphate of baryta and other foreign matter—of course, I refer to gypsum in its ground state. I have known it to contain from 30 to 40 per cent. of $BaOSO_3$, &c. It would be an easy matter to point out the cause of this, but I have no desire at present to do so. It is for those who use it to say whether they will have a "mixture" or the genuine article. For my own part, I merely point out the fact.

I notice in No. 375 of the Chemical News a letter from a correspondent relating to German yeast. I have examined very large quantities of this yeast, and, if I except sand and similar bodies, I have in no case found any adulteration. The only thing I often noticed was putrefaction going on, barely visible to the naked eye, but with the aid of a common microscope it could be seen to great advantage, and took the form of a mass of corruption, which, in fact, it was. Has your correspondent examined the flour thoroughly? The days of alum and plaster are not yet over, and it is, in my opinion, much more likely to be the flour than the yeast that has been the cause of the illness he names. Your correspondent must be aware of the injurious effect alum, &c., has upon the system, especially in persons of weak constitution, when taken for a long time together in bread, &c.

I heard a short time ago of several cases of lead-poisoning which took place in America. It turned out that the bread eaten by the persons so poisoned contained lead, which was proved by analysis, and after a further search it was discovered that a miller in the neighbourhood from whom the flour had been obtained was in the habit of filling up the holes and fractures in his millstones with lead. Of course it followed that during the process of grinding the lead gradually wore away, and became mixed with the flour. Again, I have been told of millers filling up the holes in their millstones with alum and plaster of Paris, which, when used together, form a very hard composition. I will leave your readers to surmise what in all probability followed.

I am, &c. J. H. Swindells.

MISCELLANEOUS.

The Great Pyramid Weights and Measures.—The following prospectus announces the particulars of a work, by Professor Smyth, to be shortly published by Messrs. Edmonston and Douglas, Edinburgh, under the following title:—"Life and Work at the Great Pyramid, during the Months of January, February, March, and April, A.D. 1865; with a Discussion of the Facts ascertained," by C. Piazzi Smyth, F.R.SS.L. and E., Astronomer-Royal for Scotland. In three vols., each 500 pages. Vol. I. Journal of Proceedings. Vol. II. Numerical Observations. Vol. III. Discussion of Results. "A definite interpretation having been given, within the last few years, to some of the chief features in the Great Pyramid of Egypt, by the late John Taylor, of London, the monument has been recently submitted to very painstaking as well as extensive measurements; and with the effect of abundantly confirming his idea, that the Great Pyramid was intended by its primeval designer to memorialise a system of weights and measures for the use of all mankind. Its system is moreover found to be that on which not only the sacred Hebrew, but the hereditary weights and measures of modern European nations, of Saxon and Gothic origin, were founded in the early ages of the world. Though now much disordered by anomalous subdivisions which have since crept in, the whole arrangement can yet be brought back to its pristine simplicity and excellence,

in all these countries, by a reforming process only, and without recurring to the disadvantages of a radical revolution; leaving, moreover, in most cases, the standards and chief units employed by the mass of the people nearly unchanged as to absolute amount, but with their numerical relations much facilitated by decimal and quinary proportions, and their grand foundations in nature clearly exemplified. Thus, the Great Pyramid linear standard is founded on the length of the semi-axis of rotation of the world, being the one-ten-millionth thereof; and gives both the inch, and the length of the side of an acre, the same as the British to one-thousandth part; besides affording a cubit-length which comes between the ells of the old Prussian, Danish, and other important continental nations. The Pyramid weight and capacity standard is founded on the above linear standard, in conjunction with the specific gravity of the earth as a whole. Its pound, which is in nature five cubic inches of the earth's mean density, is almost identical with the British pound avoirdupois, and exceedingly close to most of the old pound-weights on the Continent. The Pyramid heat standard is the mean temperature of the whole surface of the earth; marks boiling water at 250°; the greatest density of water, at 10°; and the freezing of water, at 0°. In the Pyramid time standards, special respect is paid to the week of seven days; and throughout the building, there is such a constant and pervading protest against all idolatry, that the monument appears to have been originally, whatever it may have been used for afterwards, not so much an Egyptian, as a Hebrew-devised structure of the inspired period, and of the age of the early patriarchs."

Curious Electrical Phenomenon.—During the late intense frost the small river which waters the valley of Glenelg was, like others, covered with ice varying from six to nine inches in thickness. This, when partially dissolved by the thaw of last week, was broken up into large plates and rapidly carried to the sea, except where it met with obstacles that retarded its progress, where it remained piled up into great masses until the weight of the water accumulating behind forced it onwards. One of these obstacles consisted of a slight wire foot-bridge, which formed a communication between the two parts of the minister's glebe, which the river divides. This bridge was supported by four pairs of wooden posts standing in the bed of the stream, and against these a great quantity of the ice had been collected, until the water, obstructed by it, rose several feet above its natural level. Things were in this condition when, about 11 o'clock on the night of Wednesday, the 23rd, one of the maidservants at the manse, having occasion to cross the stream, and not being aware of the danger, went along the bridge, and had scarcely reached the bank when the whole structure was carried away, some of the wires being broken, and the others torn from their fastenings. Had the girl been a single minute later of crossing, her life would have been sacrificed, for she must either have been drowned in the swollen stream, or crushed to death by the heavy blocks of ice. On looking back to the bridge, the girl heard sounds emitted by the breaking wires above the roaring of the crashing ice, and saw a vivid flash of coloured light at every fracture of the wires This appearance might have been supposed to be due to the fright she was in at the time, had not a sister, who was in safety on the other side of the river, seen it likewise, and also a young man who was passing at the time along the public road, more than 200 yards from the spot. The phenomenon was probably caused by the wires being strongly charged with electricity, developed by the breaking up of the ice and the friction of the detached masses—separation of parts and friction being both known sources of electric action.—*Edinburgh Evening Courant.* [This phenomenon is evidently "Smatterer's" flash of lightning repeated: *vide* Chemical News, No. 372, p. 36.—Ed. C. N.]

Meetings for the Week.

Monday, March 4.

Royal Institution, 2 p.m. General Monthly Meeting.
Medical Society, 7 p.m. Annual Election.

Tuesday, March 5.

Royal Institution, 3 p.m. The Rev. G. Henslow "*On the Practical Study of Botany.*"
Pathological Society, 8 p.m.

Wednesday, March 6.

Geological Society, 8 p.m. 1. The Earl of Selkirk "*On Ancient Sea-marks on the Coast of Sweden.*" 2. The Duke of Argyll "*On a Palæozoic Fossil from Kintyre.*" 3. W. S. Shea, Esq., "*On Recent Discoveries of Gold in New Brunswick.*" 4. W. Wheelwright, Esq., "*On the Discovery of Coal on the Western Slope of the Andes.*" 5. The Rev. R. B. Brodie "*On the Presence of Purbeck Beds at Brill, Buckinghamshire.*"
Pharmaceutical Society, 8 p.m.

Thursday, March 7.

Royal Institution, 3 p.m. Professor Frankland "*On Coal Gas.*"
Royal Society, 8½ p.m.
Chemical Society, 8 p.m.

Friday, March 8.

Royal Institution, at 8 p.m. Rev. W. Greenwell "*On the Yorkshire Wold Tumuli.*"

Saturday, March 9.

Royal Institution, at 3 p m. Professor Frankland "*On Coal Gas.*"

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

G. Lunge.—Received with thanks.

W. B.—We scarcely understand what our correspondent wants. Sulphuric acid will not dissolve carbonate of lead; it will convert it into an insoluble sulphate, and cannot be used as a test for its purity. Nitric acid would form a solution, and would probably answer your purpose.

A Reader.—Dr. Odling's lecture on Dialysis is in preparation, and will probably appear in our next number. If this does not give you the information you want, we must refer you to Professor Graham's original papers published in the *Philosophical Transactions.* Abstracts of these have appeared from time to time in the Chemical News.

Inquirer.—Your note is inserted in another part of the paper. The author of the articles has been unexpectedly called away from England. They will be shortly resumed, and continued without interruption.

Chinese Blue.—*Inquirer* wishes to know the proper method of making Chinese blue. One good plan is to grind equal weights of zaffre and potash with felspar equal to four times the weight of the mixture, fusing in a crucible and grinding the product to an impalpable powder.

Boronatrocalcite.—In the third note to this paper (last number, p. 86) it should have been stated that the old notation was used because the *new notation* is not yet very generally applied to mineralogical formulæ.

The Blowpipe.—*Dr. Muspratt* writes:—"Mr. David Forbes remarks: 'It will doubtless be admitted that in this country but very little attention has been paid to the use of the blowpipe.' This assertion I most certainly cannot endorse. It is now nearly twenty-four years since I presented, in an English form, Plattner's 'Probirkunst mit dem Löthrohre,' and since that time the blowpipe has been very generally employed, not only by the student, but by the expert in his laboratory and other operations. Several hundreds of pupils have been under me, and instruction 'upon the use and application of the blowpipe' has always been given. A gentleman, not long ago, wrote to me from Australia that he had found 'the blowpipe of much importance and use to him.' I have been engaged for some time with a fourth edition of the work, which may be published this year. Mr. Forbes states, 'Gas is not to be recommended, as it is difficult to obtain a good reducing flame when using it.' I have never experienced any difficulty." We regret that want of space compels us to omit several extracts from the preface and laudatory quotations from letters in favour of Dr. Muspratt's translation of "Plattner on the Blowpipe."

Received.—"Science Teacher;" A. B.; H. B.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Determination of the Quality of Silver prepared by different Methods, by J. Stas.

For the comparison of the silver produced and refined by different methods, I have made use of the mode of assaying in the moist way which is adopted in the Mint laboratories. I have taken care to increase tenfold the quantity of the material to be assayed.

To carry out this method with every possible condition of accuracy, I employed special arrangements that I have already mentioned briefly in my preceding work, and which I will now describe, with the suitable details, in accordance with the desire expressed by several chemists who have examined the apparatus.

The arrangement for the assay consists of three distinct parts—a reservoir containing a standard solution of chloride of sodium, a measurer, and an apparatus in which the titration is performed.

The volume of the reservoir was determined by means of the weight of the flask filled with dry air and with water. This volume at 10° was 6328·35 c.c.*

The measurer consists of a large pipette, surmounted by a long, almost capillary tube, subdivided into seventy equal spaces; it is furnished at the base with a slender tube, the diameter of the opening being 0·0015 m.

The capacity of the measurer, filled up to 0°, was determined by the diminution of weight caused by removing the water. This capacity was found to be 504,922 c.c. at 10° Centigrade.†

The measurer is permanently fixed in a glass vessel filled with water kept at a constant temperature; it is filled from the bottom by means of the liquids of the reservoir, led by a siphon provided with a glass tap, and terminated by an india-rubber tube, which fits on the narrow portion of the tube of the pipette. The measurer is provided at the top with a tap, which is opened when it is wished to fill it with liquid up to 0°, and which is kept closed when it is wished to leave the saline liquid in the vessel for it to take the temperature of the water bath that surrounds it.‡

Further to provide against variations of the temperature of the liquid, I waited, before making the determinations, until the temperature of the air in the dark room and of the water was sensibly the same.

To prepare the standard saline solution, I introduced into the reservoir 33·9653 grs. of pure salt. This weight represents 5·420 grs. of pure chloride, or 1009·844 c.c.—a volume double the capacity of the measurer at 10° Centigrade. According to my former experiments, 5·42078 grs. of pure salt should precipitate exactly 10·000 grs. of silver from the electrolysis of cyanide of silver and ammonium. I had therefore a latitude of nearly 0·001 gr. to make the assay—a more than sufficient quantity when we consider the great perfection of Gay-Lussac's method when it is properly applied.

The weighing of a previously determined quantity of chloride of sodium is an excessively delicate operation, and one it would be impossible to perform exactly if recourse were not had to an artifice. The following is that which I have employed, and to which I have always had recourse in analogous circumstances. After having calculated the weight in air§ of 33·9653 grs. of chloride of sodium, supposed to be weighed in a vacuum, which weight is equal to 33·9475 grs. I weighed, in a platinum crucible, this quantity broken into small fragments, and then submitted the crucible, enclosed in a second, to a dull red heat. Whilst the salt was still very hot, I introduced it, by means of platinum pliers, into a stoppered tube, which was also heated, and the weight of which had been determined. The tube having cooled, I took its weight, and supplied the few milligrammes wanting by weighing in an assay balance, as rapidly as possible, the quantity of chloride necessary to make up the total of the calculated weight of the chloride.

In the paragraph headed "On the Chloride of Sodium used in the Determinations, and Determination of the Proportional Relation between the Chloride and the Nitrate of Sodium," I show the method I used to procure the sodic chloride employed; I took every possible care to guarantee, as much as possible, its purity. I also give the means to which I had recourse to ascertain the quantity of foreign matter it contained, the weight of which amounted to from forty-seven to fifty millionths.‖

New Test for Cobalt in Solution, by William Skey, *Analyst to the Geological Survey of New Zealand.*

If to a solution of a salt of cobalt in tartaric or citric acid an excess of ammonia is added, the addition of ferricyanide of potassium will cause a very dark-red coloration in the solution.

So intense is the colour thus produced by the ferricyanide, that it will reveal the presence of cobalt in solution when all other tests fail, its delicacy being about four times greater than that of carbonate of ammonia.

A solution of cobalt prepared as indicated above, so as only to contain $\frac{1}{60000}$ part of cobalt, when placed in a $\frac{3}{4}$-inch test-tube, is very distinctly coloured by the addition of a soluble ferricyanide, and even when diluted down so as to contain but one part of colbalt in 400,000 parts of the liquid, the coloration is still distinctly visible in a bulk of a few ounces.

On the Action of Bismuth on Phosphoric Acid.—When a fragment of bismuth is thrown into glacial phosphoric acid infusion, the metal fuses to a bright globule, from which small flames appear. This phenomenon is sometimes so strong that particles of incandescent bismuth are thrown out of the vessel, forming a shower of sparks. There finally remains a spongy mass of bismuth, and a white powder, which is phosphate of bismuth. The flames which appear arise evidently from the phosphide of bismuth which would be formed, and which decomposes by giving up its phosphorus, or by forming phosphuretted hydrogen in contact with the water of constitution of the phosphoric hydrate.—*M. C. Braun, Zeitschrift für Chemie*, t. ii. p. 282.

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* See the notes for the data used to determine this volume, note No. 3.

† See the notes for the data used to determine the total capacity of the measurer and the capacity of the tube subdivided into seventy equal parts, note No. 4

‡ Thanks to the system of distribution of water in the town of Brussels, nothing is easier than to have, for eight or ten consecutive days, a current of water at a *constant temperature*. The greatest difference there is during the whole year in the temperature of the water does not even reach 4° Centigrade. During more than two months this temperature is very exactly 10° Centigrade.

§ I found the density of the chloride employed = 2·145; whence it results that, weighed in common air with platinum weights, it loses 0·0005366 gr. of its weight per grammo.

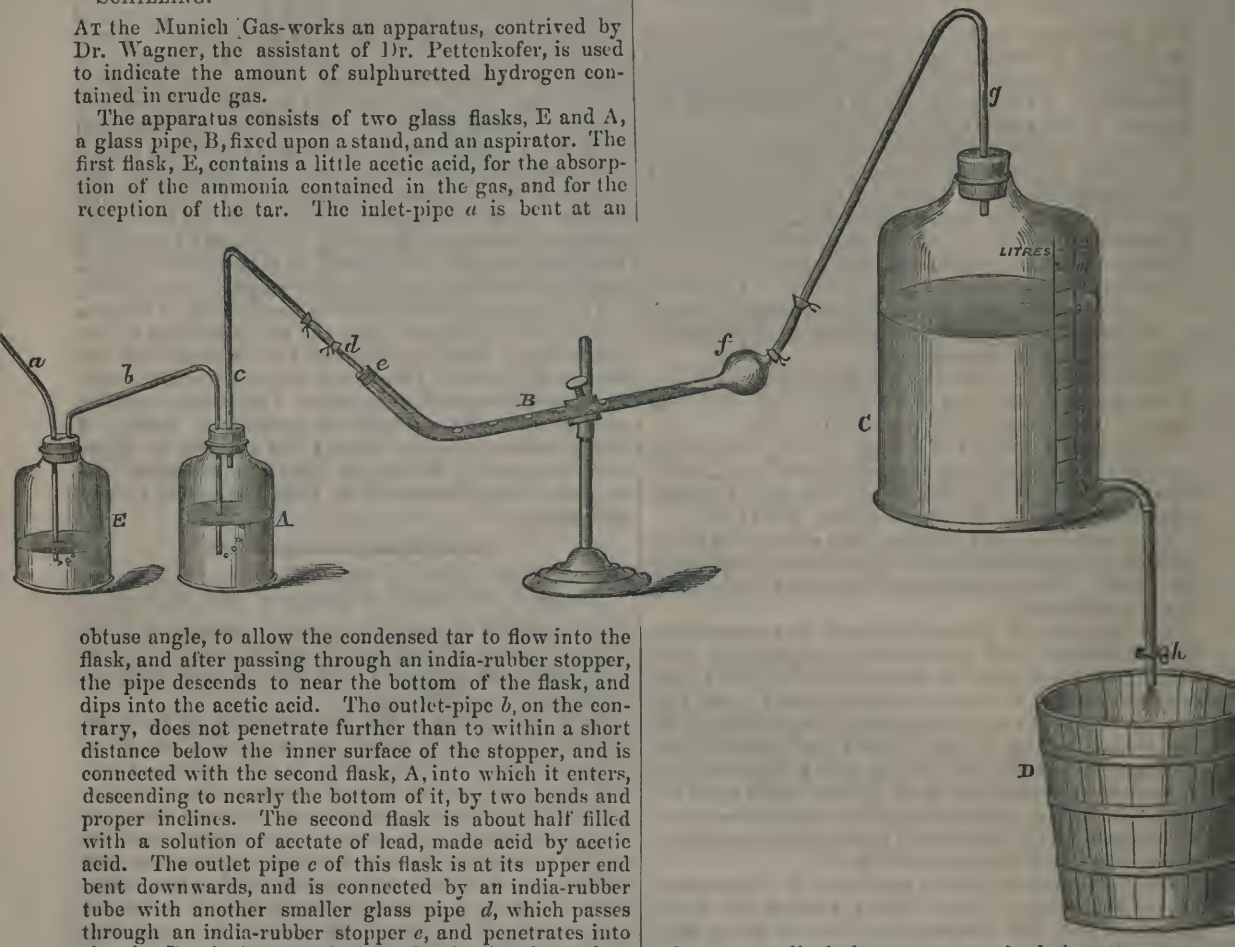
‖ By purifying, as much as possible, this chloride of sodium, and by also determining the quantity of foreign matter retained in spite of these purifications, my object was to use these new experiments for the determination of the proportional relation between silver and chloride of sodium, so as to deduce from these data the atomic weight of the silver and the molecular weight of the sodic chloride.

TECHNICAL CHEMISTRY.

Apparatus for Determining the Quantity of Sulphuretted Hydrogen contained in Crude Gas, by Dr.* Schilling.

At the Munich Gas-works an apparatus, contrived by Dr. Wagner, the assistant of Dr. Pettenkofer, is used to indicate the amount of sulphuretted hydrogen contained in crude gas.

The apparatus consists of two glass flasks, E and A, a glass pipe, B, fixed upon a stand, and an aspirator. The first flask, E, contains a little acetic acid, for the absorption of the ammonia contained in the gas, and for the reception of the tar. The inlet-pipe *a* is bent at an obtuse angle, to allow the condensed tar to flow into the flask, and after passing through an india-rubber stopper, the pipe descends to near the bottom of the flask, and dips into the acetic acid. The outlet-pipe *b*, on the contrary, does not penetrate further than to within a short distance below the inner surface of the stopper, and is connected with the second flask, A, into which it enters, descending to nearly the bottom of it, by two bends and proper inclines. The second flask is about half filled with a solution of acetate of lead, made acid by acetic acid. The outlet pipe *c* of this flask is at its upper end bent downwards, and is connected by an india-rubber tube with another smaller glass pipe *d*, which passes through an india-rubber stopper *e*, and penetrates into the pipe B to its lowest point, terminating in a fine end, so as to prevent the gas coming out otherwise than by a very narrow passage, and in small bubbles. The pipe B is about one metre long, and, as shown in the wood-cut, is also filled with a solution of acetate of lead. While the left extremity of this pipe is closed by the stopper *e*, its right has a globe *f* at the end for the deposit of any fluid that may have been carried over; and in continuation therewith is a glass tube, through which the gas takes its course to the aspirator C. This aspirator, which in this instance has a capacity of twelve litres, is closed by means of an india-rubber stopper, through which passes the inlet-pipe *g*, bent at the top, the extreme end of which, going downwards, is connected with the glass tube near the globe *f* by an india-rubber tube. At the bottom of the aspirator a small lateral pipe is inserted, with an india-rubber tube, the latter being provided with a pressure-cock (*Quetschhahn*), together with a thumb-screw, for the purpose of discharging the water.



When the apparatus is used, the gas is admitted by a connecting pipe between the hydraulic main and the condenser—nearest, however, to the former.

The cast-iron pipe is drilled at the upper part, and the ¾-inch outlet lead pipe is carried upwards—say, about 2 feet perpendicularly—to convey back into the cast-iron pipe a portion of the tar carried onward by the warm gas, but which soon becomes condensed. The lead pipe is then bent downwards, and carried about 10 feet in length to the experimental table, where it terminates with a stop-cock (*Schlanchhahn*). A short india-rubber tube is drawn over this cock so as to allow of its being connected afterwards with the apparatus. Before an experiment takes place gas is allowed to flow freely for at least half an hour through the supply pipe, in order that the inner surfaces of the same may become completely covered with tar, thus insuring that the lead of the pipe does not decompose the sulphuretted hydrogen of the gas.

After filling both the flasks and the pipe in the manner before described with the absorbing fluids, and completely filling the aspirator with water, and making tight all the connexions of the apparatus, the water is allowed, by opening the pressure cock *h*, to flow out of the aspirator until atmospheric air in the form of bubbles is sucked up by the apparatus, and until the level of the water corresponds exactly with one of the

* *Journal of Gas-lighting*, translated from the *Journal für Gasbeleuchtung*.

marked lines of the aspirator. The cock *h* is then again shut for a short time, and the loose end of the india-rubber tube fastened to the supply pipe is then drawn over the glass pipe *a*. It is of course premised that the pressure of the gas in the supply pipe is = o, as is the case in establishments where exhausters are used. Upon the connexion being restored between the apparatus and the supply pipe, the pressure cock is again slightly opened, and the gas allowed to pass gently—say about 20 litres per hour—until the water level in the aspirator has descended to the line marked 1. The flow of the gas is kept up as uniformly as possible by the regulating screw of the pressure cock. As we allow at our experiments from 40 to 50 litres to pass each time, it is necessary that the above experiment should be repeated several times. The pressure cock and the cock of the supply pipe being again shut, the stopper of the aspirator is loosened, the aspirator again filled with water, and the entire operation repeated in the manner above described.

Where no exhausters exist, and where there is a pressure of several inches in the (gas) supply pipe, no aspirators are required, but a gas-meter is used instead.

In the first flask, E, filled with acetic acid, is collected the greater portion of the tar; no absorption of sulphuretted hydrogen takes place here, as the crude gas enters it at a high temperature. In the second flask, A, and also very slightly in the pipe B, a black precipitate is formed, composed partly of sulphuret of lead, partly of tar. The latter, however, is apt to carry down with it a considerable quantity of the solution of lead employed. In order to bring the precipitate thus formed into a ponderable condition, it is first filtered, then well washed, and dried at a temperature of about 100° C., and put into a small porcelain dish. Fuming nitric acid is then repeatedly poured over it, also at a temperature of about 100° C., and this is continued until the black mass has become quite white. When this has taken place, the residue of the nitric acid is driven off by evaporation at 100°. By the above operation the sulphuret of lead is converted into sulphate of lead, the tar is destroyed, and the lead carried down by the tar is changed into nitrate of lead. It is known that sulphate of lead is insoluble in water; nitrate of lead, on the contrary, is readily soluble. For this reason the white mass is washed with water in a porcelain dish, and separated by filtration from the insoluble sulphate of lead. The latter, after being properly washed and dried, is heated in a crucible and weighed as $PbOSO_3$, from which the sulphuretted hydrogen is estimated according to the formula—

$$PbOSO_3 : HS = 151{\cdot}5 : 17.$$

The Theory and Working of Blast Furnaces, by Wm. Crossley, *F.C.S., Manager Ormesby Iron Works.**

(Continued from page 98.)

Ebelmen gives the following as the result of his analysis of the gases escaping from a furnace at Clerval in France :—

	Per cent. by volume.
Nitrogen	57·22
Carbonic acid	12·01
Carbonic oxide	24·65
Marsh gas	·93
Hydrogen	5·19
	100·00

* Communicated by the author.

Taking only the carbonic acid and carbonic oxide, we find they are in the proportion of 12·01 of the former to 24·65 of the latter in every 36·66 parts of the mixture, or 32·75 parts of carbonic acid to 67·25 carbonic oxide in every 100 measures.

The material used in the production of the above was as follows :—

295 parts Iron ore
115 ,, Charcoal
15 ,, Limestone

and the approximate composition of the mixed iron ore and limestone—

	Per cent.
Water	12·50
Carbonate of lime	21·00
Sesquioxide of iron	39·20
Oxide of manganese	·70
Silica	20·00
Alumina	6·60
	100·00
Metallic iron	27·00 per cent.

And on the assumption that the whole of the oxygen in the iron ore oxidised its equivalent of carbonic oxide to carbonic acid, and that this carbonic acid is not again reduced, we should have a gas containing the carbonic acid and carbonic oxide in the following proportions :—

Carbonic acid	33·72
,, oxide	66·58

and Ebelmen found, as already stated—

Carbonic acid	32·75
,, oxide	67·25

The nearness of the above figures to each other would certainly seem to bear out the theory I have advanced, and I may here state that from some original investigations, as well as from the analysis of the gas escaping from Ormesby furnaces, I have had the above results confirmed. I should here state that in the above calculation 15 per cent. has been deducted from the charcoal, for ash, volatile matter, and moisture.

The above results, then, seem to indicate (excuse me for stating it so frequently) that the reduction of iron takes place in a much higher and cooler part of the furnace than is generally supposed, and that the change of carbonic oxide into carbonic acid, and its subsequent reduction into carbonic oxide again, does not take place; carbonic acid once formed in the reducing region is never again converted into carbonic oxide, but leaves the furnace as carbonic acid.

If the above views are correct, they also explain another process adopted in the manufacture of iron which has always been enveloped in some amount of mystery—viz., the theory of the calcination of ironstone. There cannot be the slightest doubt that the beneficial results obtained by the calcination of ironstone are greater than would be obtained by a mere decrease in weight and the previous evolution of volatile matter by exposure to intense heat; for in calcining, besides a loss of about 20 per cent. which the ironstone suffers, the protoxide of iron absorbs oxygen and becomes converted into a higher oxide, called the peroxide—that is, every 36 parts of oxide of iron, containing 8 parts of oxygen, absorb 4 more parts, and the oxygen thus absorbed, as well as that originally contained in the ore, by oxidising their equivalent of carbonic oxide, thus assist in heating and preparing the material for the further changes it has to undergo in the lower part of the furnace.

If the above is not the case, I would ask how it can

be explained that the calcination of limestone does not give equally beneficial results with those obtained from the calcination of ironstone, when by this operation limestone loses about 42 per cent. of its weight, where ironstone only loses about 20 per cent. Taking these facts into consideration, then, I think we are justified in stating that calcination is productive of good as much from the fact that it gives oxygen to the iron as from its effect in driving off the volatile matter.

(To be continued.)

FOREIGN SCIENCE.

(From our own Correspondent.)

M. Clemandot, director of the crystal glass manufacture of Clichy, near Paris, has patented a new process of silicatising pottery, founded upon the property possessed by the alkaline silicates of dissolving easily in water, and combining with argil by the aid of heat. This can be effected either by the application of a superficial coating, or by the impregnation of the clay itself. In the first case, the clay, after being entirely or partially burned, is coated with a solution of the alkaline silicate, applied by means of a brush as often as is necessary to render the coating impermeable; it is then burned at a temperature high enough to determine the fusion of the silicates and their combination with the pottery. In the second case, the pottery-ware is steeped in a solution of the silicate, which it imbibes on account of its porosity; subjected afterwards to the action of heat, the silicate forms an impervious material. These processes, so simple, have the advantage of dispensing with the use of the oxide of lead which forms the habitual base of the glazing, which is corrosible by the weakest acids.

M. Bourne has succeeded in removing from india-rubber its disagreeable odour by operating as follows:— The articles of india-rubber are placed in an enclosed vessel, they are surrounded with charcoal dust, and submitted to a temperature of 60° to 70° C. during several hours; they are then taken out, and the charcoal is removed from them. They are thus not the least changed in form even in the most delicate details, and the odour is found to have completely disappeared. India-rubber thus treated can be placed in contact with food of any sort without risk of communicating an unpleasant odour. For heating the india-rubber we can employ either hot water, steam, or the heat even of the vulcanisation, so that the objects quit the vulcaniser completely inodorous.

M. Cordure has exceeded his predecessors by making use of the affinity of silver for lead in order to separate the latter from argentiferous lead ore. When the argentiferous lead is melted, a small quantity of zinc is added, and after an energetic brushing the mixture is allowed to repose. The alloy of zinc and silver, being lighter than lead, rises to the surface, and as it is less fusible, it cools sooner. By watching the proper moment the silver can be skimmed off, united with zinc and a small quantity of lead. The zinc and the lead are separated by remelting the skimmed mass, and oxidising by means of a current of hot air or superheated steam, and treating afterwards with hydrochloric acid; the residue is submitted to cupellation. Nothing hinders the chloride from being utilised in its actual state, or being transformed into carbonate of zinc.

To vitrify cast iron by the process of M. Paris and others, a very fusible green colour in powder is dusted over it, and the whole is afterwards submitted to a red heat in an oven. M. Balloutrey, on the contrary, places the surface to be covered in contact with the elements which produce ordinary white glass, and heats it to the point of vitrification. The iron combines, in oxidising, with the silicic acid of the glass, and the union is complete between the latter and the metal. The protective coating can be rendered as thin or as thick as may be required, but in giving a thin layer the unequal dilatations of the metals have less effect upon the separation of the metals. Experiments are being made for protecting, on this principle, the iron-plating of vessels from corrosion. They are being carried on by the French Government.

M. Jules Roth, of the Industrial Society of Mulhouse, has made some interesting researches upon the composition of raw tartrates of Alsatia and their adulteration. The tartrates of commerce coming from the wine coopers, where they are found deposited at the bottom of the casks, generally contain from 81 to 85 per cent. of white tartrate.

These tartars, in the rough, without admixture of foreign substances of the above percentage, are generally sold by druggists. The percentage in the rough tartrates of merchants and those used by dyers is very far from the normal quantity, which proves that the merchants mix them with other substances, in order to be able to sell them at a cheaper rate. For this purpose the dried lees of wine are principally made use of; these are used in great quantities in the south of France, at Bordeaux, and in the Charente, and which only contain from 6 to 7 per cent. of pure tartrate. The process of M. Dosaye, employed by M. Roth, is founded on the saturation or the neutralisation of the tartaric acid by means of a standard solution of crystallised soda, marking 14° of Decrosilles. The more alcohol the wines contain, the less tartar they form. It is the acid wines, such as those of Alsatia, the Rhine, &c., that furnish most.

Electric Light.—In a few days the electric light of the Alliance Company will be installed on board the *Prince Jerome*, the yacht of H.I.H. the Prince Napoleon; and M. Georgette Dubuisson, the excellent captain, will proceed at once with some most interesting experiments on the light. It is not to illuminate the vessel itself, but, on the contrary, to light up other objects, such as a coast or a vessel, for the sake of attack or defence; ships at full speed or in station can thus be kept free of all danger of collision, and, in action, the object to be hit can be illuminated. The regulator of the charcoal ends is to be established on board the above yacht on the principle of M. Leon Foucault, so admirably constructed by M. Duboscq. This instrument has the advantage of not only having a regular movement when in a vertical position, but also burning with the same precision inclined at any angle, so as to be independent of the pitching or rolling of the vessel at sea. The apparatus placed behind the lamp, and which, hiding the light from the deck of the vessel, projects it in parallel rays on a given spot, has been constructed by M. Sautter. It is a first essay; it is not, however, the night-glass by our friend, Dr. Jules Guyot, and which is composed of two substances placed in juxtaposition—one containing the combination of mirrors necessary for the projection in space of a pencil of parallel rays, the other a complete telescope serving to observe the point or object that the parallel rays illuminate at a distance. Since the essential data for this new problem and its complete solution, the moment has arrived for constructing perfect instruments which will leave nothing to be desired. Recourse, perhaps, must be had to the condenser, of which M. d'Henry, of Lille, has given the ingenious theory, and which increases a hundredfold the light, already so intense, of the electric focus. However late in the field of practical adaptation, the electric light once established on board a vessel will become a necessary adjunct to the marine and transport service.

The illumination of this same light for railways, in the stations and the approaches thereto, tunnels, curves, &c., has been the order of the day, and the subject of deep study for some weeks past. M. Jacquemin, director, along with the engineer of the East Railway of France assisted at experiments carried on at the works of the

Alliance Company at the Rue du Puits Artésien, Passy. They were very successful, and we have reason to expect the best results. Let those gentlemen allow us to place the focus close to the ground, so as to illuminate it and not the atmosphere.

Lastly, the question has been mooted of substituting in electric gilding and silvering, as also in galvanoplastic, of round bosses where the simple element cannot be made use of, the current of magneto-electric machines. M. Christofle and M. Bouillet have perceived that nitrous acid disengaged by the Bunsen piles were not sufficiently drawn off by the chimneys which were constructed for the purpose at great expense, and became every day more dangerous; so they have resolved to make use of electricity engendered mechanically. They made a first essay at the works of the Alliance Company, and they have ordered two machines of four discs. In the establishment of M. Lenoir, 88, Rue Popincourt, a machine of this kind has been established, which promises great success. We may add that the magneto-electric machine of Mr. Wilde has been employed also in the celebrated workshops of Messrs. Elkington, of Manchester. The current is able to deposit a pound of copper per hour, and economy and salubrity are assured. F. Moigno.

The following list of medals granted by the Société d'Encouragement completes the awards mentioned last week:—

Silver Medals.—Belou, caloric engine; Blot, statuettes in terra cotta; Bon, imitations of precious stones; Chaudun, improved cartridges; Courcier, self-acting lubricator; Guesnier, grey cast iron covered with white iron; Guiot, thermoscopic barometers; Havrez, lixiviating apparatus; Journaux-Leblond, sewing machines; Lacroix, vitrifiable colours; Mathieu, straw hats; Vidard, railway carriages.

Bronze Medals.—Beillard, door closing; Baudu, safety key; Cabel, mosaic flooring; Dumas, hypsogoniometer; Gauthier et Duchamps, sewing machines; Lecornu and Roserau, new cremonas; Masson, apparatus for measuring rations of oats for horses; Molard, locomotive with rotatory engine; Parraud (a poor working man, who came in his blouse, and was most warmly applauded), wooden taps for wine barrels and casks; Peraux, method of dividing a circle; Sanguet, longimeter; Thomas, compound compasses; Valasse, safety guard for small arms.

PROCEEDINGS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, January 25, 1867.

Sir Henry Holland, *Bart., M.D., D.C.L., F.R.S., President, in the Chair.*

A paper, by William Odling, M.B., F.R.S., was read, "*On Mr. Graham's Recent Discoveries on the Diffusion of Gases.*"

I.

When atmospheric air is separated from a vacuous or partially vacuous space by a septum, partition, or bag of india-rubber, some air passes through the septum into the originally vacuous space.

This space may be conveniently maintained vacuous, and any air passing into it be simultaneously withdrawn and delivered for examination, by means of Sprengel's exhauster.

Whereas atmospheric air consists of about 21 per cent. of oxygen and 79 per cent. of nitrogen, the air transmitted through india-rubber into a vacuous space is found to contain about 40 per cent. of oxygen and 60 per cent. of nitrogen, and to have the property of re-inflaming a glowing splinter.

A transmission, therefore, takes place through the rubber septum of both constituents of the atmosphere, but there is a greater proportionate transmission of its oxygen than of its nitrogen.

Single or unmixed gases, similarly separated from a vacuous space by a septum of india-rubber, penetrate the rubber and enter the vacuous space with the following relative velocities:—

Nitrogen	1
Marsh-gas	2·15
Oxygen	2·55
Hydrogen	5·50
Carbonic acid	13·58

From these velocities the observed passage of mixed oxygen and nitrogen gases through india-rubber is deducible by calculation; and, conversely, the separate velocities of oxygen and nitrogen are deducible from the transmission-results obtained with atmospheric air:—

Oxygen	21 × 2·55	= 53·55	.	40·4
Nitrogen.	79 × 1	= 79·0	.	59·6
		132·55		100·0

The constituent gases of atmospheric air not only pass through an india-rubber septum into a vacuous space, but also into a space containing some other gas, such as hydrogen or carbonic acid, and at the relative velocities with which they enter a vacuous space; but the conditions of the experiment then become more complicated.

In the case of an india-rubber balloon filled with carbonic acid, for instance, not only are atmospheric oxygen and nitrogen gases continually entering the balloon, but carbonic acid gas is continually and very rapidly escaping from it.

Throughout the vacuum experiment, the conditions remain constant, the hyperoxygenised air being withdrawn as fast as transmitted; but in the balloon experiment the oxygen is gradually accumulating within the balloon, whereby the conditions are constantly varying.

Eventually, by the rapid escape of carbonic acid, the proportion or pressure of oxygen in the internal mixture comes to exceed that in the external air; whereupon a reverse transmission through the balloon, of the excess of oxygen into the external air, at once begins.

II.

When ordinary coal-gas is separated from a vacuous space by a septum, partition, or tube of platinum, some gas passes through the platinum septum into the originally vacuous space, as soon as, but not until, the metal is raised to the temperature of ignition.

Whereas coal-gas is a variable mixture of marsh-gas and hydrogen with several other gases and vapours, containing on the average about 45 per cent. of marsh gas and 40 per cent. of hydrogen, the gas transmitted through ignited platinum is found to consist exclusively of hydrogen.

A transmission, therefore, of only one, and that not the most abundant, of the many constituents of coal-gas, takes place into the originally vacuous space through a septum of ignited platinum.

So that while the nitrogen of the air is transmitted through a septum of india-rubber in a much smaller ratio than its oxygen, the other constituents of coal-gas are transmitted through a septum of ignited platinum in an infinitely smaller ratio than is its hydrogen.

Experimenting with single or unmixed gases, the quantity of hydrogen transmitted through a septum of ignited platinum into a vacuous space amounted to over 100 cubic centimetres in half-an-hour; whereas, under the same conditions, the quantity transmitted of oxygen, nitrogen, marsh-gas, carbonic acid, and some other gases, did not amount to ·01 cubic centimetre in half-an-hour.

Further, the transmission of hydrogen through a septum of ignited platinum, as of various gases through a septum of india-rubber, takes place into a volume of some other gas as well as into a vacuum, but with a similar complication of results.

What is the nature of these transmissions of gas through india-rubber and ignited platinum respectively? Are the phenomena in the two cases similar or dissimilar to each other; and with what class of actions are they one or both associated?

III.

By a sufficient degree of pressure, gases may be forced through the minute channels of a porous septum; or, in other words, may pass through such a septum by *transpiration*.

But transpiration takes place only through obvious channels or pores, from which india-rubber and platinum are entirely free.

Again, transpiration through a porous septum takes place only in the direction of the preponderating total pressure; but the transmission of gas through india-rubber and ignited platinum, from one gaseous space into another, can take place in the opposite direction to that of the total pressure, and in both directions at the same time, by a sort of interchange of gases through the septum.

Moreover, the composition of a mixed gas, such as atmospheric air or coal-gas, is not altered by mere transpiration; whereas the composition of these mixed gases is greatly altered by their transmissions through india-rubber and ignited platinum respectively.

Lastly, every gas and every mixture of gases has its own special velocity of transpiration, irrelative to any other property of the gas, and irreducible to any general law. These rates are altogether different from the observed rates of transmission of the same gases through india-rubber and ignited platinum, thus:—

Oxygen	1·00
Nitrogen	·87
Carbonic acid	·73
Marsh-gas	·55
Hydrogen	·44

From these differences in the character of the phenomena, as well as from another important difference hereafter to be mentioned, it is clear that the transmission of various gases through india-rubber, and of hydrogen through platinum, is not due to transpiration.

IV.

As the channels of a porous septum become more and more minute, their resistance to the bodily transmission of gas becomes greater and greater, and the quantity of gas forced through them less and less, until at length the septum becomes absolutely impermeable to transpiration, under the particular pressure.

But such a septum, of which the individual capillary channels are so small as to offer a greater resistance, or friction, to the passage of gas through them than the available pressure can overcome, may nevertheless present a considerable aggregate of interspace, through which the proper diffusive movement of gases, due to their innate molecular mobility, may take place freely.

When any volume of gas is allowed access to a vacuous space, or to an additional gaseous space, it gradually diffuses itself throughout the space afforded it, at a rate inversely proportionate for each gas to the square root of its specific gravity.

In so far as the aggregate area of interspace available for diffusion is greatly diminished, by the introduction of a porous non-transpiring septum between the diffusing gas and the additional space afforded it, so is the amount of diffusion within a given time proportionably diminished; but in no other respect does the septum appear to take any part in the action; it neither promotes nor retards the diffusion, but simply allows it to take place in proportion to the aggregate area of the interspace which it affords.

The experimental determination by means of Bunsen's diffusionometer of the relative diffusion-velocities of different gases through a thin plate of compressed graphite —a septum without obvious pores and quite impermeable to transpiration—has given numbers which are almost identical with the reciprocals of the square roots of the specific gravities of the several gases:—

Hydrogen	3·80
Marsh-gas	1·34
Nitrogen	1·01
Oxygen	·95
Carbonic acid	·81

Interdiffusion of different gases takes place in proportion to their respective diffusion-velocities. Thus with air and hydrogen separated from each other by a graphite septum, for every 1 volume of air which passes into the hydrogen-space, 3·8 volumes of hydrogen pass into the air-space.

Mixed gases also diffuse away from one another according to their respective diffusion-velocities. As a result of even the small superior diffusiveness of nitrogen over that of oxygen, the proportion of oxygen in atmospheric air has been increased from 21 to 24·5 per cent., by the diffusion of nitrogen away from it, during its conveyance through several lengths of porous tobacco-pipe enclosed in a vacuous space.

The acts of gas-diffusion through porous septa and of gas-transmission through india-rubber and ignited platinum resemble each other in several points. They both take place through septa free from obvious pores; they both take place as well in the direction as against the direction of the preponderating pressure, and also in opposite directions at the same time by a sort of interchange; and they both effect an alteration in the composition of any mixed gas subjected to their operations.

But they differ altogether from one another in the relative velocities with which the gas-movements in each case are effected—the transmissions of gas through india-rubber and ignited platinum being at special rates, while the diffusions of gas through porous septa are inversely as the square roots of the specific gravities of the particular gases.

Thus, the specific gravity of nitrogen being somewhat less than that of oxygen, its rate of diffusion is accordingly somewhat higher, in the proportion of 101 to 95. Hence, if the passage of air through the rubber septum were due to diffusion, the transmitted air should be rather richer in nitrogen and poorer in oxygen than the original air; whereas the transmitted air is actually found to be very much richer in oxygen and poorer in nitrogen than the original air.

Again, hydrogen having a far lower specific gravity than marsh-gas, its diffusion rate is very much higher, in the ratio of 380 to 134. Hence, taking the proportion of marsh-gas to hydrogen in coal-gas as 1 to 1, and it is usually rather greater, if the passage of coal-gas through ignited platinum were due to diffusion, for every 380 volumes of hydrogen transmitted there should be 134 volumes of marsh-gas: but in reality no marsh-gas whatever is transmitted; so that neither with the rubber septum nor with the platinum septum are the results due to diffusion.

It is rare to have phenomena of diffusion undisturbed by phenomena of transpiration, or phenomena of transpiration undisturbed by phenomena of diffusion; but since the alteration in the composition of a mixed gas by its passage through a transpiring-diffusing septum is effected solely by diffusion, the results obtained with the rubber and platinum septa are not due to joint transpiration-diffusion.

V.

A septum may be quite free from pores of any kind or degree of minuteness, and so far be absolutely impermeable to the passage of gas through it in the form of gas, but may nevertheless permit a considerable transmission of certain gases by their prior solution or *liquefaction* in the substance of the septum.

The merest film of water, as of a soap-bubble for instance, is quite impermeable to gas as gas; but allows the ready transmission of a soluble gas, such as ammonia, through it, by reason of a prior solution or liquefaction of the ammonia in the film of water.

The film of water may be replaced by a moist membrane

of any degree of thinness or thickness, with a similar result.

In this case the phenomenon consists in a solution of the gas in the moist material of the septum—in a diffusion of the liquefied gas as a liquid through the thickness of the septum—in an evaporation of the liquefied gas from the remote surface of the septum—and, lastly, in a diffusion of the evaporated gas into the adjoining space.

Of the many circumstances affecting the final result, the influence of the solubility of the gas in the liquid of the septum would so far predominate over all other influences as to allow of their being left out of consideration. Whence it may be affirmed that the transmission of any gas through a film of liquid, or a moist septum, will be found proportionate to the solubility of the gas in the liquid.

But gases are absorbable not only by liquids, but also by certain solids, and especially by charcoal.

The gases absorbed by charcoal are probably liquefied in the charcoal; at any rate, the more absorbable of them occupy a bulk considerably less than if reduced to the liquid state by pressure.

All charcoal is more or less porous; but its absorption of gases is not proportionate to, or a mere physical effect of, its porosity; since other similarly porous substances do not manifest the same absorptive power, and since the absorbability by charcoal of any gas is as special a property of that gas as is its solubility in water or alcohol.

The transmission of an absorbable gas through a septum of compact charcoal, such as the cocoa-nut charcoal used by Mr. Hunter, of Belfast, which absorbs about $\frac{8}{10}$ths of its volume of mercury, and 111 times its volume of ammonia, would take place in two ways.

A portion of the gas would pass through the fine pores of the charcoal as gas, by diffusion, at a rate inversely proportionate to the square root of its specific gravity; while another portion would become liquefied in the charcoal by capillary condensation, pass through the charcoal as a liquid, and evaporate from the other side, just as would a gas liquefied by solution in a moist membrane; and it is conceivable that, in some compact forms of charcoal, the transmission of gas by gaseous diffusion might be inappreciable as compared with its transmission by liquefaction and evaporation.

VI.

Whereas the mere passage of gas through a transpiring or diffusing septum takes place in thorough independence of the nature of the material of the septum, in these last considered actions the transmission takes place by virtue of a sort of chemical affinity between the gas and the material of the septum—the selective absorption of the gas by the septum being a necessary antecedent of its transmission; whence it may be said that the gas is transmitted because it is first absorbed.

Is, then, the transmission of oxygen, &c., through india-rubber, and of hydrogen through ignited platinum, effected by a process at all allied to that of gas-liquefaction by solution or capillary condensation?

That septa of india-rubber and platinum differ from merely diffusive and transpiring septa, in effecting or allowing a selective transmission of certain gases through them, is evident; but do they first exert a selective or, in other words, a *chemical absorption* of these particular gases?

Experiment answers that they do; oxygen proving to be more than twice as absorbable by india-rubber as by water, and hydrogen proving to be fully three times as absorbable by wrought platinum as by charcoal.

The statements of fact and interpretation contained in this abstract are based upon the investigations of Mr. Graham, spread over a long period of years; and especially upon the investigations described in his more recent memoirs "On the Molecular Mobility of Gases" (*Phil. Trans.*, 1863), and "On the Absorption and Dialytic Separation of Gases by Colloid Septa" (*Phil. Trans.*, 1866).

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, February 19, 1867.

J. P. Joule, *LL.D., F.R.S., Vice-President, in the Chair.*

Mr. Sidebotham inquired whether any member was acquainted with the particulars of a remarkable discovery in connexion with the conversion of dynamical into electrical force by M. Siemens and Dr. Wheatstone, a brief notice of which appeared in the *Athenæum* of February 16.

Mr. Wilde said that he happened to be present at the meeting of the Royal Society on the 14th inst. when M. Siemens' interesting paper "*On the Conversion of Dynamical into Electrical Force, without the Aid of Permanent Magnetism*," was read. The apparatus used in his experiments, and exhibited at the meeting, consisted of two electro-magnets, coiled with long and thin wires, and between the poles of these electro-magnets an armature, also coiled with long and thin wires, was made to revolve rapidly by means of pulleys.

When a voltaic battery was connected with the wires of the electro-magnet for a few moments, and afterwards disconnected, the residual or permanent magnetism of the electro-magnets was sufficiently strong to generate a feeble current of electricity in the wire of the revolving armature. The feeble current thus generated was then transmitted through the coils of its own exciting electro-magnet, instead of the current from the battery, and by the mutual action and reaction of the electro-magnet and the armature upon each other, the magnetism of the machine could be exalted to such a degree as to require the application of very considerable power to drive the apparatus.

That this increase of magnetism was attended by an increase of dynamic electricity in the wires surrounding the armature and electro-magnet was manifest from the brilliancy of the spark at the commutator and the increased deflection of a galvanometer needle placed within the influence of the electro-magnetic circuit; but the quantity of electricity was not sufficient to ignite wires, and was comparatively small in proportion to the mechanical force expended in producing it.

The apparatus used by Dr. Wheatstone in his experiments, which was also shown in operation at the meeting, was very similar in construction, and identical in principle, with that of Siemens, though each of these experimentalists appears to have worked out his results independently.

Instead of the long and thin wire used by Siemens in his machine, Wheatstone employed coils of thicker wires, and the wire on the electro-magnet was of the same diameter, and about eight times the length of that on the armature. The coils of the electro-magnet had consequently about eight times the resistance of the armature circuit. In this arrangement, the wire surrounding the armature being the generating circuit, it follows from a well-known property of the electric circuit, that the amount of dynamic or useful effect which the current is capable of exerting when the resistance of the coils of the electro-magnets is in circuit, is about one-ninth of the total amount which the armature coil is capable of evolving when the electro-magnet is excited to the same degree by a separate battery or other electro-motor.

This peculiarity of the machine was made evident by Dr. Wheatstone in a very striking manner by means of the following well-devised experiment:—Two branch wires were led off from the extremities of the armature coil, and when the electro-magnet was fully excited the free ends of the branch wires were bridged across by means of a fine platinum wire about nine inches in length, which wire immediately became white-hot, and as suddenly ceased to be visibly hot until contact with the branch wires had been broken for a short time and afterwards re-established.

This momentary ignition of the platinum wire appeared to Mr. Wilde to be due to the diversion of the greater portion of the current generated by the armature into the

new channel or short circuit established by the platinum wire through the armature coils, before the high degree of magnetism which had been maintained in the electro-magnet by the full current from the armature had been reduced by the loss of a portion of the current so diverted.

The results obtained by Siemens and Wheatstone are undoubtedly very interesting from a scientific point of view, but, practically, the exciting of the electro-magnet by the current from the armature used in connexion with it produces results very inferior to what are obtained from similar machines, the electro-magnets of which are excited by a separate source of electricity of small power, as, in the latter case, the full force of the current generated by the armature coil is available for the performance of external work.

Mr. Wilde having himself, some time ago, made some experiments similar to those of M. Siemens and Dr. Wheatstone, came to the conclusion that, in the present state of our electrical knowledge, the difficulty of utilising the current from the armature after it had passed through the coils of the electro-magnet was insuperable; as it is absolutely necessary that the coils of the electro-magnets of electro-magnetic machines, when excited by intermittent currents, should be of considerable length, in order that they may acquire and retain a charge of electricity or magnetism, as has been shown by Drs. Henry and Faraday in their experiments on the induction of a current upon itself. On the other hand, for the production of powerful electro-dynamic effects, it is necessary that the wire of the armature coil should be comparatively short and thick. Hence the incompatibility of the armature and electro-magnetic circuits, when exalted dynamic effects, outside the machine, are required.

It is not a little interesting to observe how, in the progress of physical science, the same train of reasoning is often pursued by several individuals having no communication with one another. In the present instance, it would appear that the "augmentation of the power of a magnet by induction currents produced thereby, and reacting upon the magnet itself." has also suggested itself to other experimentalists besides M. Siemens and Dr. Wheatstone. In a letter published in the *Engineer* of July 20, 1866, p. 42, the writer (Mr. J. Murray) says:—"The description in recent numbers of the *Engineer* of Mr. Wilde's admirable improvements in the magneto-electric machine induces me to point out, if you will permit it through your columns, a variety of the principles embodied in his machine, which is so obvious that it cannot fail to be hit upon by some inventor before long."

It is briefly this:—"Whereas Mr. Wilde, beginning with an ordinary magneto-electric machine, uses the current obtained from it to charge a powerful electro-magnet, and from this obtains a second and more powerful current, which, used in like manner, produces one still more intense, I, using only a single machine, pass the current obtained from its armatures through wires coiled round the permanent magnets, in such a direction as to intensify their magnetism, which, in its turn, reacts upon the armatures and intensifies the current.

"It is obvious that the amount of mechanical force which can thus be converted into electricity is only limited by the capacity of the iron for magnetism; just as the power of a steam engine is only limited by the capacity of the boiler for absorbing heat."

Mr. Wilde has also received a letter on the subject of his recent experiments in magnetism from Mr. Moses G. Farmer, of Salem, Mass., United States, dated November 9, 1866, in which he says that he had obtained an increase of 31 per cent. in the power of a magneto-electric machine by transmitting the current from the armature through coils of wire surrounding pieces of soft iron forming the prolonged extremities of the permanent magnets of the machine. Mr. Farmer, in the same letter, adds:—'I have built a small machine in which a current from the thermo-battery excites the electro-magnet of your machine to start it, and after the machine is in action a branch from the current of the magnets passes through its own electro-magnet, and this supplies the magnetism required. It is not exactly like a person standing in a basket and trying to lift himself—because the electricity proceeds from the conversion of the mechanical energy, which must be continually supplied. Neither can it in any wise be likened to the various schemes for producing perpetual motion; but depends on the principle that the actual energy of the mechanical force, conjointly with the potential energy of the magnet, can develope a greater amount of potential energy than is originally resident in the magnet, or, in other words, it is a method of converting part of the actual energy of the prime mover into the potential energy of magnetism."

ACADEMY OF SCIENCES.

February 25, 1867.

(From our own Correspondent.)

On the subject of the assertions of M. Hermann, of Berlin, relative to the dangers of protoxide of nitrogen (laughing gas), Mr. Preterre (American dentist, of 28, Boulevard des Italiens) addressed to the Academy the following letter:—"In presence, on the one hand, of these assertions, and, on the other, of the considerable number of anæsthetics daily made use of in France by me, and also in America on a more vast scale, I trespass again on the indulgence of the Academy to request that the Commission named for this purpose will be kind enough to attend during my experiments, when I shall place myself completely at their disposal." The perfect innocuousness of the protoxide of nitrogen used by M. Preterre is accounted for by the fact that he prepares it the night before, and, after having well passed it through water, he leaves it for many hours in contact with water. Under these conditions the trioxide of nitrogen or nitrous acid, which always accompanies the protoxide, combines with the oxygen of the water, and forms nitric acid, soluble in the water, leaving the nitrous oxide gas absolutely pure.

Messrs. Bussy and Buignet presented the second part of their memoir "*On the Changes of Temperature produced by the Mixture of Liquids of Different Natures.*" The following are the very important conclusions arrived at:—1. In all the cases under examination, with one sole exception, the calorific capacity of the mixture is a little superior to the mean capacity of the elements. 2. By a singular opposition, the liquids for which the increase of bulk is the most considerable are exactly those which develope most heat at the moment of their union, such as ether and chloroform, alcohol and water, sulphuric acid and water. Meanwhile the only instance hitherto noticed of a diminution of bulk is the mixture of *chloroform* and *sulphide of carbon*, at the same time the decrease of temperature taking place at the moment of the union. 3. Independently of the loss of heat resulting from the changes of volume, there exists a cause which produces alone an absorption of heat—an absorption which can be sometimes equal, and even superior, to the heat given out by the combination of the liquids. This cause, perhaps, may proceed from the separation of the homogeneous particles necessary for the *diffusion* of the liquids.

M. Fizeau communicated the result of his researches on the dilatation of crystals. He experimented this time upon several series of salts presenting a great analogy with each other—such as the chlorides, bromides, and iodides—hoping that this analogy would be manifested by the manner in which crystals are influenced by the action of heat. His previsions are in general confirmed, and in the course of his studies he has discovered an anomaly quite singular, and which constitutes a veritable discovery. While the coefficient of dilatation of all the chlorides, bromides, iodides, is positive in the same manner as it is

for all substances experimented upon, up to the present day the coefficient of dilatation of the iodide of silver is alone negative, so that this salt, instead of dilating, really contracts. Raised to a temperature of 40° C., the coefficient is $-0{\cdot}00000139$. This coefficient is, besides, variable with the temperature and the direction in the interior of the crystal. In the direction in which the contraction is greatest, parallel to the axis, it is the $\frac{1}{7000}$ part for 100°, about a tenth of the dilatation of mercury.

General Morin presented and described an electric thermometrical register for marking in an automatic manner, every quarter of an hour, the variations of temperature in an enclosed spot or in the open air, and which was very serviceable during his experiments on ventilation. Our readers are already aware that some excellent apparatus have been invented and put in use—for example, that of the reverend Father Secchi—for registering the variations of temperature, not only intermittently, but continuously.

M. Dupré, of Rennes, Ile-et-Vilaine, has recently adapted with success the mechanical theory of heat to the transmission of sound.

M. J. M. Gougoin has addressed, on the subject of the gas-couple of Mr. Grove, a note in which he arrives at conclusions in perfect conformity with those of M. Schönbein. Mr. Grove supposes that it is indispensable for each of the electrodes of platinum of his gas-couple to be simultaneously in contact with one of the gases and with the liquid placed underneath. M. Gougoin states, on the contrary, that the action of the platinum does not take place except on the gases already below, and that the gas-receivers should only be considered as reservoirs to maintain in a state of saturation the solutions they cover. The electro-motive force of the gas-couple varies curiously with the state of the platinum wire. Its action is increased, as M. Matteucci remarked, by heating the elements in the flame of a spirit-lamp some instants before employing it. In the most favourable conditions, the electro-motive force of the gas-couple constructed with platinum wires not platinised scarcely exceeds 155, taking as unity the electro-motive force of a thermo-electric couple of bismuth and copper, the two solderings of which are maintained at the temperature of 0° and 100° C. The electro-motive force of the couple of Daniell is represented by 193, and that of the couple of Volta by 178, at the moment of being set at work.

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

279. O. Monnet-Laverpilière, Rue Notre Dame des Victoires, Paris, "A new agricultural fecundating agent."

285. W. E. Newton, Chancery-lane, "An improved process for obtaining metals from their ores." A communication from J. N. Wyckoff, Brooklyn, New York, U.S.A.—Petition recorded Feb. 1, 1867.

325. J. Wright and T. Cobley, Copthall-court, Throgmorton-street, London, "Improvements in the treatment of ores of lead for the purpose of obtaining salts and colours of the same."—Feb. 6, 1867.

337. J. Graham, Warrington, Lancashire, "Improvements in the manufacture of spelter from zinc ashes and refuses obtained when coating iron with zinc."—February 6, 1867.

379. W. Clark, Chancery Lane, "Improvements in preserving animal or vegetable matters, whether fluid or solid, in a wholesome and edible condition, without material loss or change of their natural flavour." A communication from L. H. Spear, Braintree, Orange, Vermont, U. S. A.—February 9, 1867.

CORRESPONDENCE.

Determination of Phosphates.

To the Editor of the Chemical News.

Sir,—With regard to the difference which a correspondent finds between the analysis of one chemist as compared with that of another in the amount of soluble phosphate reported, it has occurred to me that, supposing the determination to have been made in the ordinary manner, both chemists, when they found they had a first-class manure under examination, would be careful to redissolve the phosphate after burning, and again precipitate so as to get it perfectly free from adhering salts, but when the manure contained a smaller proportion of phosphate one analyst might trust to "washing well" to cleanse the once precipitated phosphate, whilst the other would treat it as he would if as large as the amount obtained from a better manure. The thorough washing of phosphates being a tedious and difficult operation, the little time expended in redissolving and again precipitating them, if not quicker, has the advantage of giving greater accuracy to the analysis.

I am, &c.

Geo. Hopwood.

Manchester.

Science Teachers.

To the Editor of the Chemical News.

Sir,—The following has just been communicated to teachers of science classes in connexion with the Science and Art Department:—

"My Lords consider the subject of examinations for certificates as teachers of science. They determine that, for the future, all candidates who obtain a first or a second class in the May examinations shall be deemed qualified to earn payments on results, according to the rules of the Science Directory, and that the special examinations in November for teachers' certificates be dispensed with."

As this change is a most important one, and likely to materially affect both teachers and pupils of science classes, I beg you will allow me space for a few remarks thereon. It has hitherto been the practice of the Department to hold two distinct examinations in science during the year—the one in November of candidates for teachers' certificates, the other of pupils of science classes in May. And it is so very obvious that this distinction should be preserved, in order that the attainments of intending teachers should be more severely tested than those of their future pupils, that the discontinuance of the November examinations is calculated to arouse, in all persons connected with the spread of scientific education, feelings of astonishment and disgust.

It might be thought that, in bringing about such a change, some cogent reasons for the step would have been vouchsafed, but there is not the ghost of an intimation of the grounds on which "my Lords" have been induced to come to their decision; and it may be safely predicted that, amongst all persons interested in science teaching, there will be but one opinion on the subject, and that not very complimentary to the judgment and common sense of the South Kensington authorities. On looking over some of the most recent examination papers, it cannot but be admitted that those for candidates for teachers' certificates differ very little, as regards the amount of knowledge required to answer the questions, from those set for advanced pupils of science classes in the May examinations; and this may have suggested to the authorities the desirability of fusing the two examinations into one, and thus, while diminishing the labours of the officials, reducing the expenses of the Department. But if economy had been the object it might have been attained in other and less objectionable ways—for instance, by discontinuing the allowance to successful candidates in November

for railway travelling and personal expenses, and letting each one pay his own expenses.

It was a feature in the November examinations that candidates were tested as to their practical acquaintance with the subject they desired to teach; and although little perhaps was required, yet the correct performance of that little was some sort of guarantee that the candidate knew how to "handle his tools." Under the new regulation, it will be impossible to test a candidate's practical skill, and the result must be to raise up a class of teachers who may be able to get a second-class or even a first-class pupil's prize as the result of their examination on paper, but who, owing to the absurd regulations in respect to science classes, may have never so much as worked with a microscope, dissected a plant, or handled a test-tube. It is such a palpable absurdity that a student in a science class should, with the limited time and advantages at his disposal, after a couple of years' study of any particular science, be considered capable of setting up as its expounder, that one can hardly help regarding those who encourage this state of things as ignorant not only of the essential qualifications of a science teacher, but of the very nature of science itself.

If "my Lords" had been really anxious for the spread of scientific knowledge amongst the artisan classes, they should have preserved the distinction between the November and May examinations, raised the qualifications of candidates for teachers' certificates, and demanded a more thorough practical knowledge of the various subjects. Instead of this, the effect of the recent regulation will be to increase largely the number of inexperienced, unpractical teachers, without adding to the strength of the science classes; and the present staff of teachers, finding the payments from the Department for small classes will not remunerate them for their time and outlay for apparatus, &c., will be compelled to give up science teaching in disgust. So utterly absurd does the whole thing appear—so ill-advised and ill-considered—that I cannot but regard it as calculated, if not directly intended, to create a prejudice against the teaching of scientific subjects; and it will cause no surprise in me if the next we hear from South Kensington be that Government aid to science classes is to be altogether abolished. I am, &c.

A Science Teacher.

Woolwich, February 23.

Chemical Notices from Foreign Sources.

Monobasic Carbon Acids.—1. Acetic acid (C = 12, O = 8).—A. Geuther refers to his former paper on this subject in "Reports of Royal Society, Göttingen," 1863, p. 281, and proceeds to inquire if the constitution of acetic acid is expressed by the formula

$$CH_2,CO_2 \left\{ \begin{matrix} HO \\ HO, \end{matrix} \right.$$

and similarly for its derivatives, whether the molecule of water contained in its salts is or is not replaceable by metallic oxides. If it is not, then the acid carbon compounds naturally split into two groups, one group in which the water is only partly, the other in which it is wholly, replaceable by bases. To the former group belong acetic acid, its homologues, and, indeed, most other acid carbon compounds; to the latter group belong oxalic and carbonic acids and the derivatives of carbonic oxide (croconic acid, &c.). To get an answer to this question, Geuther acted upon ethylic acetate with sodium, and obtained, among other products, the sodium salt of ethyldiacetic acid, or ethylenedimethelencecarbic acid (äthylendimethylencarbonsäure), carbic acid = formic acid. The formula of this salt is

$$\left. \begin{matrix} CH_2,CO_2 \\ CH_2,CO_2 \\ C_2H_4 \end{matrix} \right\} \begin{matrix} HO \\ NaO. \end{matrix}$$

It is decomposed by water, giving alcohol, acetone, sodic carbonate, and carbonic anhydride. The best mode of preparing ethyldiacetic acid is by adding strong acetic acid to the sodium salt, extracting with ether, and distilling the extract. The pure acid boils at 180·8°, has sp. gr. 1·03 at + 5°, and does not redden dry litmus. Its most characteristic reaction is that with neutral ferric chloride, with which it gives, even in dilute solutions, a splendid dark cherry-red colour. Its barium and copper salts are described. Its salts generally resemble in solubility those of acetic acid; the silver salt decomposes under water very rapidly, even in the dark. The examination of the ethyl and methyl compounds, boiling respectively at 198° corr. and 186·8° corr., confirmed the author in his view of the constitution of the sodium salt. Ammonia reacts on ethylic ethyldiacetate, giving rise to two amides, the relation between which remains the subject for further research.

Geuther thinks it not impossible that ethyldiacetic acid is sometimes present in the urine of diabetic subjects.

If sodic ethyldiacetate is heated in a stream of carbonic acid, an acid provisionally named dehydracetic $C_8H_8O_8$ is obtained; its hydrogen, barium, sodium, and calcium salts were prepared. Dehydracetic acid is crystallisable, melts at 108·5°—109°, boils at 269·6° corr., dissolves freely in boiling water and ether, sparingly in cold water.

A severe criticism of a paper "*On the Action of Sodium on Valerianate of Ethyl*," by J. A. Wanklyn,* and some caustic remarks on the—as the author conceives—tardy recognition in England of the first account of this research with reference to "*Notes of Researches on the Synthesis of Ethers*," by Frankland and Duppa,† conclude the paper.—(*Chem. Centralblatt*, N. S. xi. 785.)

Niobium.—Marc Delafontaine has studied the binoxide of niobium Nb_2O_4, and the protoxide Nb_2O_2; the former is obtained by intensely heating niobic acid in a current of hydrogen. It is an indifferent body of so great stability that it is more probable that it is the oxide of a radicle niobyle Nb_2O_2 than a niobic niobate; this oxide has been known as hyponiobium. The protoxide resulting from the action of sodium on sodic oxyfluoniobate has, until now, been described as niobium. Although resisting most reagents, it combines with chlorine, forming an oxychloride which, with the oxyfluoride and oxysulphide, establish its true composition. The metal niobium, therefore, remains yet to be isolated.—(*Arch. Sc. Phys. Nat.*, N. S., xxvii. 167.)

Di-isopropyl and Amyl-isopropyl (C = 12).—C. Schorlemmer has prepared and examined these bodies, and finds that, like other members of the marsh-gas series, they are highly indifferent to sulphuric and nitric acids, and are therefore easily purified. Di-isopropyl, boiling at 58°, forms with chlorine in the cold a body $C_6H_{13}Cl$ having the greatest resemblance to hexylic chloride, and boiling at 122°. Amyl-isopropyl boils at 110°, and forms with chlorine a body resembling octylic chloride, and boiling at 165°. These two hydrocarbons differ fundamentally in their reactions with chlorine in presence of iodine.—(*Zeitsch. Chem.*, N. S., iii. 1.)

Hippuric Acid in Animal Organisms.—Dr. Meissner and C. Shepard, in the examination of blood and other animal fluids for hippuric and benzoic acids, where the presence of succinic acid is suspected, rely on the solubility in absolute alcohol of the alkali and calcium salts of hippuric and benzoic acids, the corresponding salts of succinic acid being insoluble. Normal blood—at least that of herbivora—always contains succinic acid, but never contains benzoic or hippuric acids. The hippuric acid found in the urine of herbivora is first produced in the kidneys, and is not simply separated by them from the blood. There is no

* *Journ. Ch. Soc.*, N. S., ii. 371.

† *Annal. Ch. Pharm.*, cxxxv. 217.

clue to the nitrogenised substance which in the body of the animal becomes converted into hippuric acid. Whatever it may be, it certainly is not urea.

The observation of Lautemann, that quinic acid becomes converted in the human body into hippuric acid, is fully confirmed.

Wöhler's early observation, that the administration to human subjects of succinic acid causes an increase both of the normal quantity of that acid in the urine, and also of the carbonic acid, without influencing the excretion of hippuric acid, is also fully corroborated.

With respect to the source of the hippuric acid found in the urine of herbivora, the authors have succeeded in identifying it, partly at least, with the cuticular substance described by Mohl as a continuous membrane covering the higher plants on those surfaces which are freely exposed to the air, and by Mulder as an envelope of the epidermal cells. Its chemical relations are very imperfectly known, but it is rather more digestible than cellulose. The authors agree with Henneberg, Stohmann, and Rautenberg, who found that the addition to straw and hay, which provoke an abundant excretion of hippuric acid, of an easily digestible, non-nitrogenous substance, as sugar, causes an increase in the quantity of urea, and a decrease in that of hippuric acid. The quantity of hippuric acid excreted depends, moreover, both on the general vital conditions of the animal and on the individual; thus, a horse at work under like conditions excretes more than when it is at rest. An elevated temperature appears to increase the excretion of succinic acid and urea, and to diminish that of hippuric acid; but the individual peculiarities of the beast have, in this case, much influence.

There appears to be an intimate connexion between the presence in the urine of calcic carbonate and hippuric acid. When the latter is abundant the urine is strongly alkaline and turbid with calcic carbonate.

The authors leave open the question whether a diet which in herbivora is provocative of hippuric acid has the same effect upon man.—(*Zeitsch. Chem.*, N. S., iii. 2.)

Uric and Kynurenic Acids.—G. Meissner considers that the excretion of kynurenic acid in dogs is dependent on the particular individual experimented on. To separate uric and kynurenic acids, Meissner boils with water and barytic carbonate, filters, crystallises the barytic kynurenate from the filtrate, and separates the uric acid from the residue on the filter by means of chlorhydric acid. Kynurenic acid appears wholly or partially to obliterate the murexide reaction for uric acid.—(*Zeitsch. Chem.*, N. S., iii. 9.)

Cumol (C = 12; O = 16).—Schaper finds that nitro-cumol crystallises in long yellowish needles, fusing at 71° and boiling without decomposition at 265°. Cumidine (from nitro-cumol *viâ* tin and chlorhydric acid) crystallises from its hot aqueous solution in long silky needles easily soluble in alcohol, fusing at 62°. The sulphate and oxalate are crystallisable. Paranitroxylylic acid $C_9H_9(NO_2)O_2$ is obtained by oxidising nitro-cumol with chromic acid. It is crystallisable, easily soluble in alcohol and hot water, difficultly so in cold water, and fuses at 195°. The barium and calcium salts are crystallisable and easily soluble in water. The ethyl ether crystallises from alcohol and is easily fusible. Schaper is engaged on other oxidation products of cumol, and thinks that he has already obtained xylylic acid, fusing at 125°.—(*Zeitsch. Chem.*, N. S., iii. 12.)

Photometer.—Professor Schönbein suggests the use of a solution of cyanin as a photometer. He finds that the depth of colour which it takes on exposure to light varies in proportion to the strength of the light, and that the phenomenon occurs also in vacuo.—(*Arch. Sc. Phys. Nat.*, N. S., xxvii. 149.)

Ozone.—Professor Schönbein has studied the formation of hydric peroxide by the slow oxidation of organic matter, and finds that in most cases the co-operation of light is necessary. The action resembles the slow oxidation of phosphorus, in so far as the oxygen is split up into ozone and antozone. The antozone (positive oxygen) always remains combined either with water or with the matter undergoing oxidation, forming an organic antozonide, whilst the ozone (negative oxygen) is set free only when the substance undergoing oxidation is in the state of vapour. There are two classes of organic bodies—those which give hydric peroxide and an organic antozonide, and those which give only the latter. Some organic antozonides are very permanent—as, for instance, fossil amber.—(*Arch. Sc. Phys. Nat.*, N. S., xxvii. 149.)

Cupric Peroxide.—W. Schmid prepares this body by shaking a very dilute solution of cupric sulphate with hydrated or anhydrous manganic binoxide.—(*Journ. prakt. Chem.* xcviii. 130.)

MISCELLANEOUS.

Royal Society.—On Saturday, March 2, the President of the Royal Society (General Sabine) gave a *soirée* at Burlington House, which was numerously attended. The most striking scientific novelty was Wilde's large magneto-machine, which was exhibited in the lower library, and worked by a steam-engine. During the arrival of the guests the electric light produced was directed upon the court-yard, which it brilliantly illuminated, its direct rays almost equalling those of the sun. The same machine also fused seven feet of thick iron wire, and with the quantity armature bars of iron and platinum a quarter of an inch in diameter were at once liquefied. The new principle in magneto-electricity, discovered simultaneously by Mr. Siemens and Professor Wheatstone, was exemplified in two machines exhibited by those gentlemen, and which attracted much attention. Not the least curious object shown was a long gas flame, which, at the slightest sound of a harsh or hissing character, immediately contracted to one half of its former height. It beat perfect time to a tune played by a musical box, and was even affected by the ticking of a watch, while tearing a piece of paper threw it into a violent commotion. Among other things interesting to chemists we noticed a very complete set of thallium salts exhibited by Messrs. Hopkin and Williams, which are now about to be forwarded to the Paris Exhibition.

Blake's Stone-Breaker.—We would call the attention of manufacturing chemists and those of our readers who may be interested in mining works to a notice in our advertisement columns of Blake's patent stone-breaker, the merits of which, we think, would, if sufficiently known, cause its more general adoption. We have had the opportunity of seeing one of these machines in operation at the Welsh Gold-Mining Company's Works, near Dolgelly, and certainly nothing could be more striking than the facility with which it crushed the hardest masses of quartz and granite. Could not something of the sort be employed on the stones for the metropolitan roads, the final crushing of which is now left to be done by the wheels of carriages and the feet of horses, to the great injury of both?

First Prosecution under the Alkali Act of 1863.—On Monday last, at the St. Helen's County Court, before Mr. Judge Blair, Mr. Price, solicitor, of Manchester, applied to the judge that his costs in the case of Messrs. Leather and Co., of the Bridgewater Smelting Company, who have lately become alkali manufacturers, might be allowed. It appears that this firm was lately summoned for having allowed a large quantity of muriatic acid gas to escape into the atmosphere, contrary to the said Act, and the firm had paid the full penalty of 50*l.* into court.

Paper Pipes and Cisterns.—Chemical works suffer in common with private individuals from the effects of severe frost, in the bursting of the pipes and cisterns from which they derive their supply of water. It may interest chemists and others to know that pipes and cisterns may be made of a material which effectually resists the frost, and, strange as it may appear, the material employed is paper. The late severe frost afforded abundant opportunity for confirming the opinion expressed by Mr. Szerelmey, that the materials which he employs render paper a perfect non-conductor, and that as such it will resist the action of frost. In the open yard of his factory at the Albion Works, near Battersea Bridge, there was, during the past winter, one large brick tank containing several tons of water, the ice upon which was several inches thick. By the side of this was another, made of paper boards, the water in which was not the least frozen. Some iron pipes which supplied water to the boiler of the engine-house from the large cistern burst in several places on the thawing of the frozen water which they contained. Some paper pipes, on the other hand, filled with water, and which have been exposed in snow on the ground, perfectly kept the water from freezing. In a model house, or hut, made of paper, and which is erected on the open space, some water in bowls and pails did not freeze, though outside the building there were large masses of ice. The encaustic colours with which the exterior of the paper house had been painted, and which had also been applied to brick, iron, stone, timber, and a variety of other materials, retained their peculiar brightness and brilliancy throughout the whole period of the continued frost. These very practical and severe tests would seem to establish very fully the value of the processes. If water does not freeze under the conditions referred to, a very large amount of that discomfort and annoyance so generally experienced at the time of frost and thaw would be arrested by the substitution of these paper pipes and cisterns for the ordinary ones of lead or iron.—*Railway News.*

Pulverisation of Liquid Fuel.—Captain Schpakovski, Professor at the Russian Military College of Paul, has recently made some very curious experiments on certain applications of the "powder of liquids," or, in other words, on water, alcohol, turpentine, naphtha, and other substances, in a very finely divided condition. The advantage obtained by such minute subdivision is the obtaining complete combustion of the whole of the carbon contained in the liquid. The Captain has constructed a peculiar lamp, which may be regarded as the typical instrument of his system. The flame of this lamp, fed by turpentine, rises to the extraordinary height of two feet, and it issues from the burner with a noise that resembles that caused by the rush of steam out of a pipe; its colour is yellowish-white, and its temperature is that of the fusing-point of steel. The quantity of turpentine consumed by the lamp in connexion with the pulveriser is from two to five pounds per hour. Captain Schpakovski commenced his public experiments with the fusion of fine steel wire, which, after a few seconds, began to melt and burn away in sparks. He then gave the flame a horizontal direction, and melted a piece of copper. He also exhibited a crucible, intended, with the aid of the pulveriser, to melt pieces of copper weighing from five to ten pounds. The application to which Captain Schpakovski attaches the greatest importance, however, is the heating of the boilers of steamboats. He has constructed a small vessel, 24 feet long and 5 feet wide, with an engine of two horse-power, which performs 6½ knots an hour. The boiler is heated by four pulverisers, the turpentine being stored forward, and conducted through a tube, furnished with a regulator, to the pulverisers. The consumption of the liquid is stated to be equal to three pounds per hour per horse-power. The Captain is now engaged in the construction of a vessel of three times the above power, and he expects, in consequence of improvements in the boiler, to be able to reduce the consumption to about half the above amount. It is said that orders for twenty steamers for St. Petersburg and the neighbouring places have already been received, and that it is proposed to establish communication, by means of small vessels on Captain Schpakovski's principle, on the Neva, between the town and the islands, so that passengers may be conveyed through the canals of the Moika and of Tontaka to the central station on the Neva, where the large vessels lie that run between that place and the islands. It is not pretended that the heating by means of turpentine will cost less per hour than coals, but, as the former will not require the fires to be lighted more than ten minutes before starting, there will be a great economy in the case of very short runs like those on the Neva, which only occupy about half an hour. The new method is also applied to night signals, the lantern giving three times as much light as those at present in use.—*American Artisan.*

New Nantymwyn Mining Extension Company (Limited).—The object of the above Company is to acquire three lead-mining properties in Carmarthenshire—the new Nantymwyn, the Gilfach, and the Glan-Towy. A detailed account of each of these will be found in the prospectus.

Meetings for the Week.

Tuesday, March 12.

Royal Institution, 3 p.m. Professor Henslow "*On Botany.*"

Royal Medical and Chirurgical Society, 8½ p.m.

Photographic Society, 8 p.m.

Wednesday, March 13.

Microscopical Society, 8 p.m.

Thursday, March 14.

Royal Institution, 3 p.m. Professor Frankland "*On Coal Gas.*"

Royal Society, 8½ p.m.

Friday, March 15.

Royal Institution, 8 p.m. Mr. E. B. Tylor "*On the Early Mental Condition of Man.*"

Saturday, March 16.

Royal Institution, 3 p.m. Professor Frankland "*On Coal Gas.*"

ANSWERS TO CORRESPONDENTS.

T. Aspden.—We have written to Paris for the gentleman's address.

Mica.—A correspondent says that he has extensive mines of mica in Canada, and could supply it in large quantities at a very cheap rate. He has about half a ton of it in England, and would be glad if some one could suggest a use for it.

W. Morgan.—Write to Hopkin and Williams, 5, New Cavendish Street. They will be able to supply the article you want.

Chemicus, Liverpool.—No examination is necessary to become a Fellow of the Chemical Society. You would have to be proposed by a member, and then ballotted for.

A. B.—The exact process of bleaching paraffin wax is a trade secret, and varies at every manufactory. One of the best processes is to melt and mix it with two per cent. of oil of vitriol, by means of which all the other hydrocarbons are carbonised. The remaining paraffin is then washed with hot water mixed with colourless photogen, and filtered hot through animal charcoal. The paraffin is thus rendered white, and may be separated from the photogen by distillation.

MacAdam.—We are unable at present to give our correspondent more particulars than are contained in the article alluded to.

E. C. C. Stanford.—The journal quoted can be seen either at the British Museum or at the Patent Office Library; or it can be procured from the Continent through Asher or Trübner.

H. B.—Tetrachloride of carbon has only recently attracted attention in the commercial world: we are therefore unable to give information on the manufacture, applications, and market of the same.

A. B.—The *Moniteur Scientifique* is published by Dr. Quesneville, Rue de Buci, 12.

Received.—"Fitzetlenne;" W. B; T. P. Blunt.

Books Received.—Dictionary of Chemistry, part xxxvii.: Sodium—Stilbite; Chemical Manufactories' Directory of England; the *Technologist* for March; Photographs of Eminent Medical Men, part i.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On Oxygenated Water, by M.* Schönbein.

The object of the present paper is to ascertain within what limits oxygenated water can resist spontaneous decomposition, or that provoked by heat. The author some time ago stated that oxygenated water, conveniently diluted, might, with impunity, be submitted to distillation; and he has now proved by experiments the correctness of this assertion. The test employed consisted of a standard solution of permanganate of potash, which is (as Mr. Brodie has shown) integrally reduced to protoxide of manganese, when in presence of oxygenated water.

As 100 grammes of the standard liquid contain four decigrammes of permanganate, there is then a milligramme of $\ominus$ per gramme of liquid, which destroys just as much $\oplus$ in the oxygenated water, provided, however, that the latter has been acidulated with sulphuric acid.

M. Schönbein has thus ascertained that oxygenated water is really weakened by boiling, but that nevertheless, when properly diluted, it is not wholly destroyed; so much is this the case, that it may even be concentrated by this means, and that generally, the more it is diluted with water, the better it resists the action of heat.

As to that which represents the deficit, it is not, as might be supposed, destroyed; it goes forth with the vapour, and condenses with it, so that oxygenated water is afterwards found in the receiver.

Metallic vessels should not be used in these operations, as they exercise a decided decomposing action on oxygenated water; while glass or porcelain is quite harmless. Cellulose also has no appreciable effect on it, for after soaking in oxygenated water either unsized paper or pure linen, and then drying,† the author has found in them the characteristics of oxygenated water by means of the following reagents—with tribasic acetate of lead, a yellow-brown precipitate; with a mixture of prussiate and ferric salt, a blue coloration. A similar coloration is also developed—1, by iodised starch, with the addition of a little ferrous sulphate; 2, in chromic acid, containing a little dilute sulphuric acid; 3, in tincture of guaiacum with the addition of some blood-corpuscles.

Dyed with indigo, and then plunged into a solution of diluted ferrous sulphate, the paper reagent quickly loses its colour, and the same thing happens when it has been dyed with cyanine blue.

Placed in dry and well-stoppered flasks, the paper will retain the power of producing these reactions for several weeks. It keeps especially well in dry air, but naturally loses its antozone when placed in ozonised air.

M. Schönbein has taken advantage of this property of lignin of fixing without altering HO_2, for ascertaining the presence of this peroxide in the vapour emanating from a liquid containing only $\frac{1}{2000}$ of HO_2. A strip of paper, dried over sulphuric acid, was, for this purpose, suspended in a flask containing the oxygenated liquid. In less than an hour the paper had acquired the property of turning blue in presence of iodised starch, much diluted, and with the addition of a trace of ferrous sulphate. The more concentrated the liquid, and the higher the temperature, the more quickly and the better does the paper become charged with oxygenated vapour, though it will become fixed even at 0°—a longer time being required for this. At about the boiling point, one minute is sufficient to blue even the ordinary ozone test-paper.

An almost equal sensitiveness is manifested by paper steeped in tincture of guaiacum, freshly prepared, then in corpuscles of blood; the same also with cyanine and indigo previously impregnated with ferrous sulphate.

After referring to his former researches on the production of oxygenated water, and proving that this body may be formed at a high temperature, M. Schönbein adds that we are far from being acquainted with the truth about oxidation, and that, for the present at least, we can hazard no theory of this phenomenon.

* *Journ. prakt. Chem.*, xcviii. 66.

† The water used contained ½ per cent. of oxygenated water.

TECHNICAL CHEMISTRY.

The Theory and Working of Blast Furnaces, by Wm. Crossley, *F.C.S., Manager Ormesby Iron Works.**

(*Continued from page* 114.)

Looking at these facts, it seems to the writer that what is wanted in the production of iron in the present form of blast furnace is the formation of carbonic oxide (CO) at the earliest possible moment after the blast enters the furnace, and also the greatest intensity of heat near the point at which it enters—in other words, localisation of heat with early production of carbonic oxide (CO). The recent improvements that have been made with a view of favouring the conditions for obtaining this object are two—

1st. Heating the blast;

2nd. Increasing the capacity of the furnace—

and I shall endeavour now to describe in what manner these may affect the combustion of coke and effect a saving in it.

On the first point I shall only risk one conjecture of my own.

Increasing the temperature of the blast gives increased affinity between the oxygen and the carbon, so that immediately the blast enters the furnace and comes into contact with the coke, combination takes place between the carbon of the coke and the oxygen of the blast; consequently the heat is more confined as to space, and more intense than if the combustion took place higher up the furnace, as it does where unheated blast is used.

I think there cannot be the slightest doubt about the importance of intensity of heat. In my opinion, without intensity of heat it would be impossible to make foundry iron at all, because, excepting at very high temperatures, combined carbide of iron cannot be decomposed into "graphitic" carbon and iron.† With some iron ores—as the Cleveland—it is almost an impossibility to make grey iron with cold blast, because with cold blast a sufficiently high intensity of heat is not obtained.‡

Again, the early removal of oxygen leaves a higher column of coke unacted upon, so that it is free to carbonise the iron as it trickles through; and it follows, also, that the sooner carbonic acid is formed—that is, the nearer the tuyeres it is formed—and nearer the tuyeres also is formed the carbonic oxide, and, lastly, the higher the column of material for the heated gases to pass through, therefore the cooler the gases are when they leave the furnace, and, further, more highly prepared is the material when it comes to that point where cast-iron and slag are formed. Thus, all the conditions

* Communicated by the author.

† I look upon "grey" cast-iron as a carbide of iron, but for my present purpose it will answer equally well, in discussing this question, to accept the view usually taken. See Chemical News, July 25, 1863.

‡ See *Transactions* of Society of Mechanical Engineers, Glasgow.

are better fulfilled with hot blast than with cold, and it is by contributing to the required condition in so high a degree—especially in the intensity of heat produced—that the hot blast effects such a saving in coke. At the same time, it must be admitted that the above does not altogether explain the results obtained, and perhaps the best further explanation of any that I have seen, or, indeed, that has been advanced, is the one given by Mr. Charles Cochrane. In this short paper I shall scarcely have time to give his views fully, but I trust to be enabled to make them sufficiently well understood.

In the furnace we have found that the coke is not perfectly burnt into the highest oxide of carbon, but only imperfectly burnt into the gas known as carbonic oxide, whereby it only gives out a very small portion of the heat it is capable of evolving; for instance, 1 lb. of coke, if properly burnt into carbonic acid, is capable of raising the temperature of 14,544 lbs. of water 1°, but if burnt into carbonic oxide only, the heat given out will be but 4453°, or in the proportion of 1 in the latter case to 3·26 in the former. Now it is very evident that any fuel that may be used outside the furnace and perfectly consumed, will be capable of saving the imperfectly burnt fuel inside the furnace in this proportion. Mr. Cochrane supposes that it is by heating the nitrogen of the blast from its initial temperature (say 50°) to a much higher temperature (say 1000°) by the perfect combustion of coal or other fuel outside the furnace, that so great a saving is effected; for instance, it is supposed that we force every minute 4500 cubic feet of atmospheric air into the furnace, and as 1000 cubic feet of air weighs 76 lbs., the weight of blast entering the furnace every minute will be 342 lbs., of which 263 lbs. is nitrogen.

$$\frac{263 \times 950 \times \cdot 25}{4453} = 14 \text{ lbs. carbon,}$$

per minute; and as this quantity of blast is capable of combining with 59 lbs. of carbon per minute, the saving in coke due to heating the nitrogen to 950° is about 25 per cent.

In my own opinion, we ought to take the oxygen of the blast into consideration, as well as the nitrogen, and in that case the saving would be about 18½ lbs. in every 59 lbs. of coke.

The next question for discussion is the capacity of the furnace and the relation between height and width. There cannot be the slightest doubt about the good hitherto resulting from increased capacity. It is well known that in some furnaces in the Cleveland district a saving of at least eight cwt. of coke per ton of iron made has resulted from this alone; but whether that benefit is due to increased width or increased height is not so easily determined. It seems to the writer that capacity—if that be all that is required—can be more easily obtained from greater diameter than from height; and the material, in wide furnaces, will have as much chance of absorbing the heat from ascending gases as in high ones, the only difference being that we have less gas passing over the same horizontal area than in the others; but inasmuch as it travels slower, the material has more time to absorb the heat it contains. But, apart from the question of absorption of heat and preparation of material, there is the equally important question of irregularity in the working of the furnace; for no saving in fuel can well compensate for "scaffolding" and "slips," and although 50 feet may be high enough for furnaces 18 or 20 feet in diameter, it may, for the purpose of promoting regularity in the working, be requisite to increase the height for a greater width. We ought, however, to consider well before adding much to the present height of our furnaces, with the great cost attending it, and also the increased working cost of raising material to great height.

The highest furnaces known are Messrs. Bolckow and Vaughan's, at Eston, which are 96 feet high. The widest furnaces are some building by Mr. Morrison, at Ferry-hill, near Newcastle, which are said to be 29 feet wide. Perhaps even greater good may be gained by increased capacity in the furnace, but it is evident a limit must be reached when the saving is counterbalanced by increased working expenses; and there can be no doubt this will be soon attained, for the temperature of the escaping gases is already reduced to 380° F. in furnaces 75 feet high and 21 feet wide. In furnaces 55 feet high and 15 feet wide, the temperature was 800° F.; and the saving in tons of coke per week in a furnace making 250 tons of iron per week on 25 cwts. of coke per ton, from this cause alone, will be

$$\frac{2949 \times 420 \times \cdot 25}{4453} = 69 \cdot 5 \text{ tons.}$$

The above calculation is made on the assumption that 2949 tons of gas is evolved per week; data from which above has been obtained will be given further on.

(To be continued.)

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, March 12, 1867.

The Mulhouse Industrial Society has proposed for the chemical arts the following subjects for prizes:—An important improvement in the bleaching of wool and silk. An industrial preparation obtained in the crystallised state from dye woods. A remarkable improvement in colour engraving. A better system of dyeing and soaping vats. Manufacture of an ultramarine, which, thickened by albumen and fixed by steam in the ordinary way, is not subject to any alteration, and preserves its clear and brilliant colour. Process of dyeing or fabrication of linen printed by organic bases. To prepare one or the other of the following colours:—metallic red, dark-green, and violet; also plastic garnet colour, capable all of being printed with a roller when thickened with albumen. A substance suitable for thickening colours, stucco work, and plaster, and capable of being employed with an economy of at least 25 per cent., instead of all the substances in use up to the present time for different purposes. Means of fixing charcoal grey otherwise and more solidly than by albumen. How do the molecular substitutions affect coloured organic compounds? Application, to the manufacture of printed goods, of the action of light and electricity upon the substances which are coloured by these agents. A substance able to replace, for all purposes, dry egg-albumen, in the impression of colours on tissues, at the same time presenting a considerable economy on the albumen. (Decolorised albumen from blood is cheaper than the albumen from eggs, always soluble in water, and capable of coagulating by heat.) Can indigotine be regenerated from its sulphuric components? What are the degrees of humidity and of heat at which the acetated mordants are decomposed most advantageously and the most rapidly? The employment of resins for the bleaching of cotton goods. New use of the yolk of eggs. Indelible ink for marking linen, &c. New machine with rollers capable of printing at least eight colours at a time. Solvents of aniline colours cheaper than the alcohols, having the same advantages, and not coagulating the thickeners. A process of fixing aniline colours more com-

pletely than by albumen. Introduction into commerce of caustic baryta at the maximum price of 15f. the kilogramme. New mode of treating different lubricating oils for machinery. The effects of different sorts of cotton in the bleaching and dyeing of tissues. Theoretical and practical study on cochineal carmine. Process of manufacturing aniline red otherwise than by arsenic acid. A simple, easy, and practical process of preparing the soluble protosalts. Aniline black soluble in any medium serving for dyeing, and able to resist the action of light as well as the aniline black already known. Aniline black for printing by rollers. A blue that can serve for tinting wools and for resisting vaporisation. Scarlet red derived from an alkaloid susceptible of applications similar to those of aniline, that will be less perishable than those, and not dearer than cochineal. Brown, maroon, and cinnamon colours from an organic base. Means of repeating, by a natural or artificial organic base of any description, the processes of the preparation of aniline colours, red, violet, blue, green, and black tints. The manner of forming the copper rollers for printing cotton goods, &c., so as to preserve their original diameter, without affecting the quality of the metal in the case of the application of a new design.

The chemical manures of M. George Ville commence to attract the attention of agriculturists, especially of those who have to grow great quantities of industrial plants, such as sugar-cane, beetroot, flax, &c. The following is the summary of the results of the experiments made by M. A. Cavalier at Mesnel-Saint-Nicaise (Somme) :—In a ground exhausted by four successive crops, obtained without manuring the land, giving only 18 hectolitres of wheat per hectare, instead of 28, the average return, six plots of ground were taken, of the size of an *are* each, and separated one from the other by a deep furrow. The following manures were applied :—To the first, five kilogrammes of sulphate of ammonia, two kilogrs. of phosphate of lime, two kilogrs. of common potash, two kilogrs. of lime ; to the second were added all the above elements except the lime ; to the third, five kilogrs. of sulphate of ammonia, two kilogrs. of pure phosphate of lime, two kilogrs. of lime, but no potash ; to the fourth, no nitrogen, two kilogrs. of pure lime, two kilogrs. of potash ; to the fifth, five kilogrs. of sulphate of ammonia, two kilogrs. of pure carbonate of potash, two kilogrs. of lime, no phosphate of lime ; to the sixth, no manure. No serious accident took place to hinder the vegetation from thriving, and the following is the result for the return of the crops per hectare (2·471 acres) :—For the first, complete manure 51 tons per hectare ; second, omitting the lime, 47·445 tons ; third, same complete manure, omitting the potash, 25·34 tons per hectare ; fourth, complete manure, leaving out the nitrogen, 36·834 tons ; fifth, same complete manure, omitting the phosphate of lime, 37·881 tons ; sixth, without manure, 25·550 tons. In comparing the first plot with the sixth, we perceive that the chemical manures have given an increase of the roots to an extent of 25·500 tons per hectare—that is to say, the produce is simply doubled ; beetroot being sold at 20 francs the ton and the chemical manure at 395 francs per hectare, the profit is equal to 115 francs.

M. Cavalier continued his experiments upon the plots of an are, each by transferring them to two hectares of ground —about 5 acres—and they were not less conclusive. The first hectare had received 650 kilogrammes of sulphate of ammonia, 800 kilogrs. of phosphate of lime, 200 kilogrs. of pure carbonate of potash, 200 kilogrs. of lime ; it produced 59·640 tons of beetroot, even when perfectly cleaned, and the leaves and fibres cut off. The second hectare had received the same manure, but with only 400 kilogrs. of sulphate of ammonia instead of 650 ; the produce was 45·325 tons of beetroot. These two series of experiments, well carried out, prove also that if the potash, the phosphate of lime, and the lime contribute very much towards the vegetation of the beetroot, the nitrogen seems to act the principal part.

M. Leroy, at Varesne (Oise), has made on his part experiments, the results of which are expressed by the following figures :—

Complete manure . . .	62·370	tons per hectare.
Same without phosphate .	48·330	,, ,,
Same without potash .	42·390	,, ,,
Same without nitrogen .	28·350	,, ,,
Phosphate of lime alone .	18·900	,, ,,
Lime alone . . .	9·450	,, ,,

If we consider the produce obtained on limed land as the expression of the real fertility of the soil, the complete manure gives a net profit of 52·920 tons.

In a quite recent note inserted on March 3 in the International Bulletin of the Imperial Observatory, and on the 8th inst. in the bulletin of the Scientific Association of France, M. Le Verrier resumes on the cometary theory of shooting stars, and persists in attributing the honour of it to himself without condescending so mention the name of Schiaparelli, whose letters, however, have been published in a journal of great authority, the meteorological bulletin of the College of Rome, issued under the superintendence of the Rev. P. Secchi, and were translated by the writer before M. Le Verrier had published a single word of his researches. We are really frightened by this system of organised cool-blooded appropriation, and more so by these lines, the effect of which has been even more coolly calculated :—*Sir John Herschel, who, along with his son, Alexander Herschel, has paid great attention to shooting stars, gives his complete assent to* the theory of the swarms of November. Poor M. Schiaparelli ! Happily the *Astronomische Nachrichten* have collected the necessary papers, and he will soon be in a position of having his revenge.

M. Mohn, director of the Meteorological Institute of Norway, has proved by numerous observations the extraordinary influence of the ground on the direction of the wind which blows against the coasts in winter. During the month of January, the cold air which covers the earth flows towards the sea, comparatively warm, producing thus a really constant land breeze, which modifies and diminishes the velocity of the gales in the upper portion, and alone can pass the mountains ; rejected by the cold air of the earth, the lower portion takes a southern direction without being able to reach the land.

On November 14 last, the sky being clear, M. Mechin, who was travelling towards Ispahan (Persia), observed, in all its splendour, the shower of shooting stars. Every second millions of luminous points dropped from the firmament and fell into space. Several stars trained a long tail like that of a rocket. F. Moigno.

Paris Exhibition, Chemical Department.—We understand from Mr. Howard, Chairman of Class 44, that Mr. Bockbinder (Messrs. Mazaroz's representative in London), who has gone over to Paris to look after the interests of exhibitors who had placed their cases in his principals' hands, that the cases are all erected, and the allotments consequently secured. The glazing will commence immediately, and he has no doubt but that every case will be ready for the reception of goods by the 20th, before which time it will be useless for exhibitors to think of unpacking their goods, owing to the dirt and confusion. A number of men are employed by him in collecting the packages of goods of each exhibitor, and placing them before the cases. Owing to the overworked condition of the railways, it will be of little avail making inquiries about individual missing packages just at present, but we learn that the consignments are coming forward with fair regularity, and there is no doubt but that the regulation as to March 10 will be relaxed.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, March 7.

DR. W. A. MILLER, M.D., F.R.S., *President, in the Chair.*

THE minutes of the previous meeting were read and confirmed. Messrs. George Ottley and Joseph Ince were formally admitted Fellows of the Society, and the following gentlemen were duly elected—viz., Major R. C. Stewart, Deputy-Assistant Adjutant-General to the Forces, Horse Guards; Mr. James Campbell Brown, Aberdeen; Mr. William Price Bonner, 69, Mark-lane; and Mr. J. Hersee Freeman, Stratford-house. The names of candidates proposed were Mr. John Mackay, 119, George-street, Edinburgh, and Mr. David Skinner Kemp, Bombay.

Mr. E. T. CHAPMAN read a short paper "*On the Oxidation of Formic Acid.*" The author finds that formic acid will not survive the oxidising influence of an aqueous solution of chromic acid, being in this respect entirely different from the acids both of the acetic and aromatic series, which have been lately shown to resist a treatment of this kind. A quantitative result was quoted in support of the fact of formic acid being converted under these circumstances into water and carbonic acid.

A "*Note on the Synthesis of Formic and Hyposulphurous Acids,*" by Dr. A. Dupré, was next read. After Kolbe had demonstrated the synthesis of formic acid by the action of an alkali metal upon carbonic acid, the author conceived that a parallel reaction would give rise to the production of a hyposulphite. The change duly occurred when sodium amalgam was brought into contact with aqueous sulphurous acid, thus—

$$2SH_2O_3 + 2Na = SHNaO_2 + SHNaO_3 + H_2O.$$

No formic acid was generated by the action of zinc upon an aqueous solution of carbonic acid heated in a sealed tube, but distinct traces of the acid were obtained by boiling under pressure gas-coke, or carbon obtained from tartar, and a strong solution of an alkaline carbonate, and afterwards distilling with sulphuric acid. The author considers it probable from his experiments that the constitution of formic and hyposulphurous acids is identical, and that the atomic expression of the latter may be simplified by adopting a halved formula, thus—

$$Na_2H_2S_2O_4 = 2(NaHSO_2).$$

Hyposulphurous acid would thus become the formic acid of the sulphur series.

Mr. CHAPMAN confirmed the observation of Dr. Dupré, by stating that a formiate was generated by the fusion of carbon with a caustic alkali and pouring the hot mass into water. Another method of synthesis was noticed in the case of dissolving cast-iron nails in chromic acid and distilling the product.

Dr. F. CRACE CALVERT gave some details which he had observed in the manufacture of formic acid by the oxalic acid and glycerine plan. The product seemed to be formed tardily at first, but on repetition of the process with the same glycerine and fresh amounts of monohydrated oxalic acid the action unfolded in a very regular manner.

Dr. ODLING offered some remarks in support of the opinions advocated by Dr. Dupré, whose experiments were first commenced in his laboratory. The destruction of formic acid under circumstances where acetic acid survived was capable of explanation on the ground that there might be, as assumed by Laurent, differences between the mono- and bi-carbon acids as great as between those containing three and four atoms of carbon. Dr. Calvert's anomalous result might be the consequence of the production in the first instance of a formiate of glycerine which subsequently became decomposed.

Mr. CHAPMAN preferred to assume that an oxalate of glycerine was first formed which split up under the action of heat into formic and carbonic acid with regeneration of the glycerine. The speaker did not object to halving the formulæ of the hyposulphites, but would not allow that sulphur plays the part of carbon, or that there was any analogy between the two acids under discussion.

Dr. F. CRACE CALVERT made a preliminary statement of the results of a series of experiments in which he is at present engaged. The author finds that a large proportion of the mineral phosphates contained in cereal grains, peas, beans, and even cotton, may be extracted by digestion in water. The solutions thus obtained always held in solution much magnesia. Cotton wool of twelve kinds was operated upon, and the amount of phosphoric acid extracted was about one two-thousandth part of the original weight of the vegetable substance. He had determined in several instances the proportion of phosphates before and after treatment with water. Dr. Calvert also mentioned incidentally a fraudulent practice of adding weight to cotton goods by brushing over them an aqueous solution of chloride of magnesium.

Mr. SPILLER said that the observation of Dr. Calvert reminded him of an experiment which Dr. A. W. Hofmann used to show in his course of lectures at the Royal College of Chemistry—namely, that by the addition of ammonia to the aqueous extract of malt, or pale ale, an abundant precipitate of white crystalline ammonio-magnesian phosphate was formed.

The PRESIDENT confirmed this statement by remarking that Liebig had shown him the same experiment many years ago, whilst on a visit in Germany.

Dr. CALVERT described likewise some interesting results obtained by the action of carbon (boxwood charcoal) impregnated with oxygen upon a variety of compounds; thus sulphurous acid and sulphuretted hydrogen were both immediately converted into sulphuric acid, alcohol became acetic acid, wood spirit was changed into formic acid, fousel oil into valerianic acid, &c.

The PRESIDENT moved a vote of thanks to the respective authors, announced the date fixed for the members' dinner (27th instant), and adjourned the meeting until March 21.

PHARMACEUTICAL SOCIETY.

March 6, 1867.

G. W. SANDFORD, *Esq., President, in the Chair.*

Dr. JOHN HARLEY, F.L.S., read a paper "*On Some of the Preparations of Conium of the British Pharmacopœia.*" The author has, during the last few months, been engaged in ascertaining the value of the conium preparations; he published the result of his experiments with the tinctura conii fructus of the British Pharmacopœia in the January number of the *Pharmaceutical Journal.* These experiments went far to prove that the tincture is almost useless as a remedial agent, for Dr. Harley has not only administered it to patients in large doses without perceiving any of the effects of conium, but he has also taken it himself, in doses varying from ʒss. to ʒij., without experiencing any effect, excepting a stimulant action from the larger quantities of spirit. There was no sense of fatigue, neither drowsiness nor tendency to inaction, no disorder or diminution of muscular power. The pupil, definition in the vision of near and distant objects, the pulse, and all the functions remained in their usual state, and the secretions were active and normal, so that it is evident that the tincture is an inert preparation when given in proper medicinal doses. Dr. Harley now gives the result of his experiments with the succus conii, which he described as a useful preparation. He had taken it in doses varying from ʒij. to ʒvss. The first dose was taken without any effect, but after the larger doses he experienced to a greater or less degree those symptoms which had not followed the large doses of the tincture. He believed that

the use of tobacco greatly interfered with the effects of conium. A person who smoked half an ounce of tobacco in the day would become less excited after a dose of a preparation of conium. The author said that he was now engaged in ascertaining the value of the extract; up to the present time the results he had obtained were unsatisfactory, but he hoped to publish further researches on the subject. He then drew the attention of the meeting to some preparations of conium which had been carefully prepared by Mr. Hemingway from the fresh plant, and also to a preparation which had retained its properties unimpaired for three years.

Professor Redwood could not recollect the exact wording of a communication received from Dr. Christison, but he believed it was to the effect that Dr. Christison had a sample of extract of hemlock prepared twenty years ago by the late Mr. Jacob Bell, which still retained its efficacy as a medicine.

Mr. D. Hanbury thanked Dr. Harley for his paper, and referred to Dr. Harley's zeal in conducting these experiments on himself.

Dr. Harley said that it was usual to perform experiments on the lower animals, but he believed this was in many cases insufficient.

Dr. Attfield also thanked Dr. Harley for his paper, saying it was a subject of especial interest to them as pharmaceutists.

Mr. D. Hanbury, F.L.S., read a paper "*On the Necessity of the Cultivation of Medicinal Plants.*" He had intended to read a paper "*On the Cultivation of Jalap,*" but he afterwards thought it desirable to alter the title. After remarking that those medicinal plants which were indigenous to our own country were cultivated with care and attention and collected at a proper time, Mr. Hanbury referred to the various causes of the high prices of many important drugs, mentioning scammony, jalap, kino, ipecacuanha, &c., saying that he believed they would be procured at lower prices, and in better condition, when cultivated by civilised and intelligent men. He also mentioned calumba, hemidesmus, chiretta, &c., as plants which would be materially improved if they were cultivated by the aid of intelligent skill. Mr. Hanbury concluded his paper by commending the subject to their further attention.

The thanks of the meeting were given to Mr. Hanbury for his interesting paper.

Mr. A. F. Haselden commenced reading a paper "*On the Codex and the British Pharmacopœia compared;*" but as the time had expired before Mr. Haselden had proceeded far with his paper, he consented, at the request of Professor Bentley and the Chairman, to postpone it to the next Pharmaceutical meeting.

ROYAL INSTITUTION.

A Course of Six Lectures "*On Coal Gas,*" by Dr. Frankland, F.R.S. (Lectures I. and II.—March 7 and 9, 1867.)

Sketch of the Apparatus and Processes used in the Manufacture, Purification, and Distribution of Coal-gas—The Philosophy of the Light of Coal-gas—Source of Light in a Gas Flame—Comparison of the Illuminating Effect of Gas with that of Candles—Construction and Use of Photometers.

In the first lecture the ordinary process of gas manufacture was briefly explained, by means of diagrams and by an experiment, in which the process of manufacture was followed as far as could be expected in a lecture. The several gases of which coal-gas is chiefly composed were individually examined with regard to the amount of light yielded by them. Dr. Frankland then proceeded to an inquiry, which, from the novel way in which he treated it, possessed great interest—"What is the source of light in a flame? Does it proceed from the suspension of incandescent particles?" This, it is well known, is the usual explanation of our text-books, but the lecturer had recently been led to doubt its truth. The audience were invited to follow an experimental examination of the facts in support of and those in opposition to the generally accepted theory.

Non-luminous flames—such as hydrogen and carbonic oxide—were burnt from jets, and very finely divided carbon sifted into the flame; the luminosity then approached somewhat to an ordinary gas flame. A plate was held over a non-luminous flame, and there was no deposit; a luminous one treated in the same manner deposited sooty matter. These experiments appear to support the received explanation of the phenomenon.

Hydrogen and oxygen, when enclosed in a strong vessel and ignited by an electric spark, gave a brilliant flash; evidently no solid particles can exist in this flame. Hydrogen was burnt in atmospheric air, and subsequently in chlorine gas. Though not very great, there was a marked increase in the luminosity; this, again, cannot result from solid incandescent particles.

Bisulphide of carbon, ignited in atmospheric air, gave little luminosity, and upon a cold surface deposited a little sulphur; fed with a stream of oxygen, the brilliancy of the combustion was greatly increased; no sulphur or carbon can exist unoxidised in this flame. Other experiments in opposition to the old theory were the combustion of a mixture of nitric oxide and the vapour of bisulphide of carbon, and of arsenic in oxygen. These experiments at least prove that a brilliant flame may be produced under circumstances in which no solid incandescent particles can exist in the flame.

A few experiments were shown to indicate that temperature exerted an effect upon the light-giving power of flames.

The increase of light produced by the combustion of sulphur in oxygen, in comparison with sulphur burning under ordinary circumstances, was attributed to the great increase of temperature. The vivid combustion of phosphorus in oxygen was explained in the same manner. The lecturer did not believe that the great luminosity in this case was dependent on the suspension of solid particles, for the reason that the product formed would be volatilised at the enormously high temperature produced; but he did not advance this example as pointing with the same conclusiveness as the preceding experiment. Temperature apparently exercises an effect upon the flame.

The bearings of experiments performed previously, but the description of which we have preferred to defer till now, were examined with regard to the density of vapours and gases. These experiments were the combustion of a mixture of oxygen and hydrogen, and of hydrogen and chlorine, under circumstances which admitted of free expansion. These mixtures, in fact, were exploded, and the attention of the audience was drawn to the almost absence of light. When these experiments are contrasted with those made under which, in the one case, the great expansion was resisted, and in the other case—that of hydrogen and chlorine—in which it did not come into play (the combination taking place in insufficient quantity to produce a sudden rise of temperature), they cannot but strike an observer with the fact that vapour density exercises some influence on the luminosity of flames. This was still more apparent in the following experiment:—Arsenic was burnt in oxygen, in an apparatus which enabled a partial vacuum to be created, and the supply of oxygen to be regulated. Upon diminishing the current of oxygen, and partially exhausting by means of an air-pump, the light became gradually fainter and fainter.

A diagram exhibiting the vapour densities showed that steam, hydrochloric acid, carbonic acid, and arsenious acid possessed greater vapour densities than hydrogen, the numbers ascending in the order in which they occur immediately above. Experiments in which these compounds

were produced by combustion followed the same order, the combustion of hydrogen and chlorine giving, next to hydrogen, the least light, while arsenic in the oxygen gas gave the most.

Dr. Frankland stated that he believed the luminosity of a gas flame was due to the condensation of hydrocarbons richer in the number of atoms contained in a standard volume than the original constituents. The suggestion was thrown out whether the sooty matter deposited on a coal surface might not in great part consist of rich hydrocarbons such as pyren and cyren. Certainly hydrogen, as was mentioned, is known to exist in it.

The conclusion of the second lecture was devoted to the methods of estimating the amount of luminosity possessed by flames. The shadow photometer and Bunsen's were described, and their use shown. Dr. Letheby's modification of Bunsen's photometer was likewise exhibited, which, though it depends in the first principle upon Professor Bunsen's, is so greatly elaborated and improved as to possess a far higher degree of accuracy.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

PHOTOGRAPHICAL SECTION.

February 20, 1867.

Dr. J. P. Joule, *F.R.S., &c., Vice-President of the Section, in the Chair.*

A paper, by Joseph Sidebotham, Esq., was read, "*On the Reversed Action of Light in Photography.*"

Those who have for many years been engaged in photographic pursuits, either as amateurs or professionals, have (especially when trying some new process) met occasionally with very curious results—failures as photographic pictures—but of the greatest value as remarkable results of the effects of light. These were probably much more frequent in the early days of photography, when we were dependent in a great measure on our own manufacture of chemicals, even to the preparation of ether. Unfortunately but few of these curiosities, as we may call them, have been preserved; in the desire to produce good pictures these have been thrown aside, and too often the causes of the strange results have not been ascertained. This is the more to be regretted as discoveries of great value may be hidden under these so-called failures. On a former occasion I exhibited here a collodion positive, on glass, of a landscape, with the natural colours, red, green, and blue, very fairly represented, although much duller than in nature. This was an over-exposed picture, and not noticed particularly until a day or two after it was taken, and all my subsequent attempts were unsuccessful to obtain another similar picture.

It is well known that when plates are over-exposed in the camera the action of light becomes reversed; thus, a sky which ought to be black becomes transparent, and a print from this looks somewhat like a negative on paper. Still the action is by no means regular, and there are many points connected with this action which require careful investigation.

It is my intention to bring some of these before you this evening in a brief manner, and to exhibit some curious specimens in illustration.

All photographers must have noticed now and then, where two lines of light and dark meet, that the light is rendered more intense just at the edge of the black or dark object. In portraits of gentlemen this is sometimes very prominent; the dark figure is thrown up as intended from the light background, but the latter is so much more intense just round the figure that it has sometimes the appearance of light streaming from behind. This effect is sometimes seen in landscapes—round a tower or even a tree projected against the sky runs a line of intense white much deeper than the sky itself. On the other hand, it sometimes happens that in a landscape with mountains the edge against the sky seems to be robbed as it were of a portion of its intensity, and so when printed exhibits a dark edge.

Again, it is well known that the sky, seen through small openings in trees or small windows in a ruin, is much more intense in a negative than the great mass of the sky; also that in taking an interior view, where light streams through a window in front of the camera, the effect produced on the negative is as if the light came round, illuminating to some extent the inside, and gradually as it were eating away the tracery of the window.

In some cases where the bright sky is seen through an opening of the trees, the trees and branches around the opening are converted in the photograph into pure white tracery on a darkened sky, and the remainder of the picture quite natural; in some cases, again, one half of a photograph may be correct as a positive, and the other, the distance exactly like a paper negative. I bring with me for exhibition specimens of these several effects, which appear intimately connected together, and deserving of our attention.

The question for us to consider is whether these effects are to be accounted for altogether by the received theories of the reversed action of light on iodised plates or paper when exposed too long in the camera—in other words, what used to be called solarisation—or whether, to some extent at least, these are not copies of the natural effects as the camera sees them, and as we should see them if we looked aright.

In Tyndall's work on the glaciers of the Alps is a reference to a curious phenomenon he saw, where the trees and shrubs projected against the sky showed as brilliant white. He says this phenomenon is rarely seen by guides or travellers, perhaps because they avoid looking towards the brilliant sky. He also quotes a letter from Professor Necher to Sir David Brewster, describing the same phenomenon. He says he has seen it at different times of the day, and says that the appearance of the trees projected against the sky is as if they were made most delicately of the purest silver. At pages 180 and 181 are sketches, which, as you will see, are wonderfully like the photographs I have to show.

That some of these effects can be accounted for I am well aware, but when taken together there is much that is inexplicable; the explanation for one case will not suit another. I would, therefore, make the suggestion that, in some states of the atmosphere, these bright lines are to be found in nature, either visible, or of such actinic power as to produce the results you see; there are certain effects in nature—for instance, the streaming light of the sun from behind clouds—of which the camera takes no notice, and on the other hand, there may be effects in nature invisible to us, but which act like invisible rays of the spectrum with great chemical intensity.

The following photographs were exhibited to illustrate the above remarks:—

No. 1. Showing white lines round figures, and chair in carte de visite portrait.

No. 2. Showing white line round church tower and yew tree.

No. 3. Showing white line faintly above the hill, also the increased depth of shade at the extreme top of it.

No. 4. Showing intense white line dividing landscape from sky, also the railings on bridge against the sky showing intense white, whilst those against the trees are black.

No. 5. Curious compound of positive and negative, the house, road, trees, &c., in foreground being positive, and correct, the sky black, and the distant trees and buildings white.

No. 6. Bridge and stream, Fountains Abbey. Showing the foliage around the opening to sky traced in pure white, the other part of photograph being natural.

No. 7. Showing the blurring of dark tracery when light streams through a window.

No. 8. Showing one of the distant hills reversed, appearing light against a dark sky, the other mountains appearing natural.

Mr. Dancer remarked that several years since he had attempted to explain the marginal appearances which some photographic negatives exhibit, by supposing that the force which governed the deposit forming the picture was more energetic at the abrupt boundary line between a light and dark object than on other parts of the exposed sensitive plate where there was less contrast, this intensity of force bearing some analogy to that which is observed on the edges of bodies influenced by magnetic, electric, or chemical action. More recent observations had induced him to alter this opinion. He thought the phenomena were caused by interference of light accompanied by diffraction fringes of colour produced by the projection of a dark body against a bright sky. The actinic effect of these fringes might possibly be increased or decreased according to the amount of chromatic correction of the camera lens for the primary and secondary spectra. Mr. Dancer stated that he had frequently noticed the reversed action of light from over-exposure; with the old daguerreotype process he had obtained very perfect negative instead of positive pictures. On one occasion, in 1840, he accidentally exposed an iodised daguerreotype plate in the camera much longer than the usual time; in this picture the natural colours of the objects were brought out in a marked degree. This picture he exhibited to many friends, but from not being fixed it faded after some time. Subsequent attempts on the same objects failed in obtaining the natural colours.

SOCIETY OF ARTS.

On the Synthesis and Production of Organic Substances and the Application which some of them receive in Manufactures, by Dr. F. Crace Calvert, *F.R.S., F.C.S., &c.*

Lecture II.

(*Continued from page* 105.)

It may be interesting to some of my hearers to know what changes take place when fruits are converted into jelly or marmalades; and whilst on this subject I may state that there is no doubt that a part of what is sold as Scotch marmalade is made from carrot juice, sweetened with a little sugar, and rendered bitter with peel of the bitter Seville oranges. I have the pleasure to present to you some marmalade and jellies that have been made from carrots, and which, from their quality, leave no doubt that, with a little skill and practice, a very agreeable condiment can thus be produced. But setting this aside, let me state that when fruits are heated the pectase converts the pectose of the fruits into pectine, and if then sugar is added, and the whole filtered, the pectine solution, as it cools, becomes gelatinous, and constitutes the ordinary fruit jellies; but ladies or cooks must take great care not to boil these too long, or they will get into a chemical difficulty, for, under the influence of heat, pectine will first be converted into pectic acid, and then into metapectic acid, when no jelly will be produced. Therefore, great care must be taken not to boil the fruit syrup with the sugar more than a few minutes before it is clarified with a little albumen, or white of egg, filtered, and allowed to cool.

Having thus studied some of the interesting conversions of starch into sugar, under the influence of artificial and natural chemical actions, let us examine together the transformations which sugar is capable of undergoing under various chemical and molecular actions; and this cannot fail to interest you, as man has availed himself of these transformations to obtain some of the most abundant and valuable products which he employs, either for his health or as a beverage. It is especially the transformation of sugar into alcohol on the one hand, and the conversion of alcohol into various products; and, on the other hand, the transformation of sugar into mannite, the sugar of manna, or its conversion into lactic acid and butyric acid, that I wish to dwell upon for a few minutes. Several of the conversions of sugar into other substances are effected under the peculiar action of certain ferments, which ferments are microscopic plants or animals.

Having already explained the conversion of sugar into alcohol by means of a ferment, and the further transformation of that alcohol into acetic acid by another ferment—the one called *Mycoderma vini* and the other *Mycoderma aceti*—it would be loss of time to enter again into the subject here; but there is one fact which has come to light since then, and which appears to me sufficiently interesting to justify my calling your attention to it. I stated last year that many of the diseases to which wine is subject were not due, as was believed by chemists and others, to mere chemical transformations of the various substances constituting that liquid, but to peculiar and well-defined ferments which develope themselves in that fluid under special circumstances, and which are the cause and the source of various classes of disease to which wines are liable. The knowledge of these facts has proved most valuable, for it has enabled M. Pasteur to devise a very simple method for arresting the decomposition or decay of wines. M. Pasteur's plan consists in heating diseased wine to a temperature of about 130°, when the ferments are destroyed, and all that is necessary to restore the wine to its original state is to allow the dead ferments to settle as a deposit, and then to decant the wine.

I may state here, *en passant*, that a M. Lamotte has proposed and carried out with success a method of "ageing" wine rapidly. It consists in submitting the wine for a few days to a temperature of about 100°, when it will be found that, after allowing the wine to stand for a short time, it has acquired the flavour of a seasoned vintage.

Let me resume the subject of my lecture by stating that the transformation of sugar into mannite is also due to a peculiar ferment, which is a modification of the *Mycoderma vini*, for this ferment is produced by boiling in water the ordinary one, and then mixing the so boiled ferment with a saccharine fluid; a very slow fermentation ensues, the saccharine solution becomes viscous, and if then its composition is ascertained it is found to be represented by a gummy, neutral, viscous substance, and a crystallised white matter, called mannite, one of the chief constituents of manna, which is used as a purgative in pharmacy. If, instead of introducing into a sugar solution one of the above-mentioned ferments, it is mixed with albumen, or the curd of milk, or several other animal substances, and chalk added, after a short time the mass assumes a thick gelatinous appearance; and if then it is chemically analysed, it will be found that the sugar has unfolded itself into lactic acid, each equivalent of sugar giving rise to two equivalents of this acid, a substance which is found to characterise the acidity of milk, and which also exists in the gastric juice of man and many other animals, also as acid lactate of lime in the muscular flesh of man and of animals, and which, lastly, is also a constant product in the slow fermentation of flour, in warp-sizers' vats, and in curriers' clearing pits. We thus observe the value of a science which is able to trace, to define, and to characterise the production of a substance from its original source—namely, starch or sugar into the stomach of man—and to proceed from thence into the manufacturer's operations such as those which we have just mentioned. A science which can so well trace the production of a substance and its influence in the medium in which it is found to exist, and can give, as I have shown in my former lectures, an explanation of the various functions it fulfils in the instances I have cited, must be indeed a science worthy of your attention, and worthy of the encouragement of the members of this Society.

There is still another transformation of sugar, through the medium of a ferment, which is not less curious and instructive than those just referred to. Here the transformation is not due to a vegetable ferment, but has been traced and proved to have its source in animal life. The ferment is represented by a little microscopic straight figure having a vibratory motion, and hence called *vibrio*. These microscopic animals transform sugar into that noisome fluid which characterises rank butter, called butyric acid, and which substance in its turn can be transformed, as I shall tell you in my next lecture, into a compound called butyric ether, sold in large quantities as the fruit essence of pineapple, used extensively for imparting that flavour to sugar drops.

Since I delivered this lecture to the Society of Arts, there has appeared a paper by M. Bechamps, which presents such a peculiar interest that I must be excused if I here introduce it to the notice of the reader. This learned chemist has gone a step further than Ehrenberg, who stated that most of the chalk formations were represented by the remains of microscopic animals, several of which, by the perfection of their fossils, he was able to define and name. But Bechamps has discovered that, besides the remains of antediluvian periods, there exist at the present time large quantities of microscopic animalcula, which he has named *Microzyma cretæ*, found by him to exist in the centre of large blocks of chalk, taken out at a depth of 200 feet under the surface of the soil by means of a tunnel driven into the sides of a mountain. What enhances the interest of this discovery is that, if some of this chalk is placed in a saccharine solution, butyric and lactic fermentation ensue.

(To be continued.)

ACADEMY OF SCIENCES.

(From our own Correspondent.)

March 4, 1867.

The correspondence was absolutely *nil*.

M. J. E. Benjamin Valz, formerly director of the observatory of Marseilles, born at Nismes, May 28, 1787, died at Marseilles, February 22 last. He was a sincere lover of astronomy, and devoted his entire life to it. He published a great number of notes and scientific memoirs; and to have become for ever celebrated, all that was necessary for him was to have had a little generosity. Being a rich man, he should have spent a little money for the necessary repairs of the Marseilles observatory, and remained there at his post up to his death.

M. Becquerel (elder) read a paper on the study of the variations of temperature of the ground at different depths, made by the aid of the electric thermometer. The conclusions arrived at are the following:—

1. At 1 metre beneath the surface of the ground the mean temperature continues increasing from winter to summer as in the air. The difference between the maximum and the minimum is 6° C. in the ground, and 18·17° in the air.

2. At 6 metres deep the variations occur in the inverse order, the maximum taking place in winter; the difference between the maximum and the minimum is 1°.

3. At 11 metres deep the variation is not more than 0·3°; the maximum takes place in winter, the minimum between the spring and summer.

4. From 16 to 26 metres the variations follow the same law as in the air, with this difference, that the difference between the maximum and the minimum is only 0·27° C. This anomaly or inversion of the law is due to the infiltration of water through permeable strata. M. Delesse has found that 16 to 26 metres are the depths of the water beds which supply the wells of the Jardin des Plantes and the neighbourhood.

5. From 26 to 31 metres the variations follow the laws the opposite to those of the air.

6. From 31 metres the variations of temperature attained scarcely 0·12°, the temperature being sensibly constant.

M. Kirchhoff transmitted, through M. Henri Sainte-Claire Deville, an answer to the objections of M. Faye against his theory of the spots on the sun, which he attributes to two clouds superposed, and formed, the lower one directly by the cooling of the solar photosphere, the other superior by influence. M. Faye replied immediately, and maintains that the explanation of the illustrious German physician is not in any way astronomical, and is not supported by any observation. M. Faye read afterwards a last memoir for the purpose of answering the difficulties that the movement of certain solar spots opposed again to his theory of the solar reflection and parallax. He has confirmed the fact, which passed unnoticed up to the present time, that when, after the apparition of a beam or fillet of light thrown from one side to the other, a spot is divided into two parts, one of the halves, as if it had received an impulse in front, takes an abnormal motion of its own, while the other half continues alone its normal movement, with variations of velocity which only depend on the latitude.

M. Blanchard communicated, in the name of M. D'Arrest, Professor of the Faculty of Lille, observations tending to prove that slight embryogenical deformations or monstrosities can become the starting-point of the constitution of a race.

M. Le Roux read the *résumé* of his experimental researches on the velocity of propagation of a concussion communicated to a gaseous mass enclosed in a cylindric tube. His aim was to measure it at a uniform temperature. The conclusions arrived at from 77 determinations, taken by processes quite new, that the propagation of the concussion is 330·66 m. per second. It is an approximation within $\frac{1}{1600}$th part.

March 11.—*Public Annual Meeting.*

M. Laugier, the President, proclaimed the prizes awarded for the year 1866; M. Delaunay gave a lecture on the moon and its importance in astronomy; he replaced M. Elie de Beaumont, who was to have enumerated the services of one of the members deceased. With the exception of the great prizes of mathematics, for which no competitors presented themselves, and the subject being passed in silence, the choice of the laureates, however, is admirably made, and with excellent intentions. The lecture by M. Delaunay on the moon was very interesting; he analysed all the astronomical labours thereupon, from Newton down to our present day. Differing from the school of Laplace, he gave to the earth's satellite the providential functions with which she is endowed. One is to enlighten the earth, but there are others which are sacrificed to the first. The crowded assembly remained calm, but attentive; they applauded the speaker when at the end he pleaded nobly the cause of science purely speculative, which has often a result of great future utility, although for the present it seems completely sterile. The prizes were rapidly distributed.

Prize for Astronomy.—Mr. MacLear, for the mensuration, at the Cape of Good Hope, of an arc of the meridian, and the publication of his great work, "Verification and Extension of La Caille's Arc of Meridian at the Cape of Good Hope," two vols., 4to. The celestial amplitude of the arc measured by Mr. MacLear differs only by a small fraction of a second from the amplitude found by La Caille, and this agreement contributes to maintain the reputation of the French astronomer.

Prize for Mechanics.—M. Tresca, for his celebrated studies on the flowing of solids under heavy pressure.

Prize for Statistics.—Dr. Brochard, for his memoir on the mortality of nurslings in France.

Most honourable mention was given to M. Parchappe,

for the reports on the central prisons and houses of correction.

Honourable mention to Dr. le Fort for his work on foundling hospitals and the charitable institutions for the accouchement of women at their houses in the principal States of Europe; to Dr. Girard de Cailleux for his statistical documents on lunatic asylums at Auxerre.

Bordin Prize, 1866.—Determination of the indices of refraction (with respect to the spectral lines) of glasses of different sorts which are employed for optical or photographic purposes. M. Baille, of Aix (Bouches du Rhone), obtained the prize; honourable mention to M. E. Mascart.

Bordin Prize, 1864.—Determination of the lengths of some well-defined rays of light; the prize given to M. Mascart. His memoir in the report is certainly the deepest and most satisfactory that has been made since Fraünhofer relative to the lengths of wave of which the light is composed. And M. Angström!

Frémont Prize.—For having aided a *savant*, without resources, in the expenses of labours and experiments for discoveries or improvements in the sciences or the liberal arts. Presented to M. Marc-Antoine Gaudin, the disinterested author of molecular morphagen and so many inorganic experiments.

Prize for Experimental Physiology.—Honourable mention to M. Colin, Professor at the School of Alfort, for his experiments on anomalous heat; also to M. Philipeaux for his experiments on the regeneration of the spleen of animals. M. Knoch, of St. Petersburg, for his new researches on the broad bothriocephalis. M. J. Cheron, for his researches on the dibranchial cephaloda.

Prize for Medicine and Surgery of 100*l.* to Dr. Béraud for his surgical, topographical, or regional anatomy; 100*l.* to M. Anger for his iconographic treatise on surgical maladies; the same to M. Marey for his researches on the nature of the contraction of the muscles in animal life. Honourable mention, with 60*l.* recompense, to M. Labarde for his work on softening and congestion of the brain; to M. Sappay for his researches on the structure of the fibrous and fibro-cartilaginous parts; to Henry Lionville and Augustus Voisin, for studies on curare. Honourable mention to M. Demarquay for his essay on medical pneumatology; Dr. Labordetta for his speculum of the larynx; M. Bouchut for his work on diagnosis of the maladies of the nervous system by the ophthalmoscope; M. Empis, granulous diseases known by the name of brain fever, granulous meningitis, galloping consumption, &c.; M. E. Fournié, physiology of the voice; M. Cahen, cholera, and treatment by arsenic; Dr. Lemaire, phenic acid and its action; Dr. Gimbert, structure and texture of the arteries; Dr. Polaillon, structure of the nervous peripheric ganglions.

Prize for the Application of Electricity to Therapeutics.—(Postponed for three years.) A medal of the value of 60*l.* was awarded to Dr. Namias, of Venice, for the unceasing efforts he has made in order to respond scientifically to the question proposed by the Academy, and the interesting observations he has already made.

Grand prize for Surgery, for the preservation of the limbs by means of the periosteum. The prize of 800*l.* was divided equally between M. Sedillot, chief surgeon of the army and the Faculty of Strasburg, the inventor of the method of extracting the interior of the bones, and M. Ollier, a surgeon much younger, but of great merit, director of the Lyons Hospital, for his applications of the first method of purely sub-periosteal treatment.

Prize for Unhealthy Occupations in the Arts.—M. Galibert, for his respiratory apparatus, by means of which any one can enter into the most mephitic atmosphere. Most honourable mention, with 40*l.* gratuity from the Montyon fund. We sincerely congratulate him.

The Bréant Prize.—Nature and treatment of cholera. 80*l.* to Messrs. Legros and Goujon, for their experimental researches on the cholera, its transmission, and epidemic nature during 1866; 48*l.* were awarded to M. Thiersh, for his experiments upon the toxic principles of choleraic dejections; 32*l.* to M. Baudrimont, for his analyses and observations relative to epidemic cholera; the same sum to M. Worms, for his work on the propagation of the cholera, and the means of restraining it. Honourable mention to M. Lindsay for his experiments on the transmission of the disease by the emanations from the clothing and the dejections of cholera patients.

The Cuvier Prize was awarded to M. Baer, of St. Petersburg, for his collection of researches on embryogenic and other zoological matters.

The Jecker Prize was awarded to M. Augustus Cahours, for the precision and exactitude of his experiments on the compounds of antimony, tin, &c., with the carbides of hydrogen in the category of the ethyls, methyls, &c.; also upon the densities of vapours which do not act as gases, except at temperatures far beyond their boiling point.

Barbier Prize.—20*l.* to M. Lailler, for his researches on native opium; the same sum to M. Debeaux, for his essay on the pharmacy and materia medica of the Chinese.

Godard Prize.—40*l.* to Drs. Aimé Martin and Henri Leger, for their researches on the anatomy and pathology of the female organs.

Savigny Prize, founded by Madame Letellier, was awarded to M. Leon Vaillant, for his researches during his voyage in the Red Sea during the year 1864.

Desmazieres Prize.—M. Roze, for his delicate and skilful researches on the antherozoides of a great number of cryptogamic plants and their theory of reproduction.

Thore Prize.—M. Fabre, Professor at the Lyceum of Avignon, for his memoir on his new observations upon the hypermetaphose and habits of the meloid class of insect.

Thus our Academy of Sciences has awarded nearly 4000*l.* worth of prizes for the encouragement of scientific progress in all its forms. On this subject it occupies a position quite exceptional, and not to be compared with any other scientific body of the old or new world.

NOTICES OF BOOKS.

A Dictionary of Photography. Edited by Thomas Sutton, B.A., editor of "Photographic Notes," and George Dawson, M.A., Lecturer on Photography, King's College, London. London: Sampson Low, Son, and Marston. 1867.

Now that photographic processes, lenses, and chemicals have multiplied to an extent that makes a practical acquaintance with the whole of them almost an impossibility, such a work as the present becomes a necessity to photographers, who would otherwise, when requiring information upon any particular subject, have to wade through a complete set of the photographic journals, with, after all, only a chance of finding what is wanted. With the assistance of this dictionary any information connected with photography may be at once obtained, and where space will not permit of many details, the reader is referred to other works where the subject is treated at length.

In a limited space it is, of course, difficult to confine each subject to the dimensions prescribed for it by its comparative importance, and in such a matter considerable latitude must be allowed to individual opinion; still we cannot help thinking that a little more brevity in some of the subjects would have been advisable, as it would have left space at liberty to be bestowed where more details were really wanted. In a work like this, for example, no one would look for a regular treatise on the principles of optics, or for the formulæ according to which the different curves of lenses are calculated, while the connexion of polarised light with photography is certainly not easy to discern. In short, we think that in a future edition the usefulness of the book might be materially increased by condensing

or erasing much of the portion relating to the optics of photography, and replacing it by additional details in the various processes, more particularly in those that are at present imperfectly known to the majority of photographers, but which seem likely to play such an important part in the future of the science, such as Swan's carbon printing process and Major Russell's rapid tannin process on bromised collodion.

In the article on Lenses there is much information given that all photographers should be acquainted with, though unfortunately the formidable aspect of the diagrams and algebraical equations will deter many from reading it. The best landscape lens is said to be Ross's actinic doublet, while among single view-lenses the preference is given to the deep meniscus, by which a perfectly flat field may be secured. This property was discovered by Mr. Sutton about two years ago. Mr. Sutton's panoramic lens is favourably mentioned, but will hardly, we think, be much used, as it requires the negatives to be taken upon spherical bowls or cylinders of glass, and the picture when completed must be bent into the same form to give a correct representation of the view. The principle of Mr. Grubb's well-known aplanatic lens is said to have been tried and condemned by the late Mr. Andrew Ross five-and-twenty years ago.

A just tribute is paid to the beauty of the daguerreotype process, which has been so long and undeservedly neglected. We insert some of the remarks, with which we cordially agree, in the hope that attention may be again directed to this beautiful process:—

"A fine daguerreotype exhibits microscopic perfection of detail and perfect gradation of shades. Other processes, when compared with this, are coarse and imperfect in the results, and of all known methods of representing a natural object by photography, the daguerreotype process is the most perfect and scientific.

"A daguerreotype is permanent; the picture cannot be rubbed off the plate, the plate cannot be broken by accident, the picture will bear microscopic investigation. Other processes have their merits, but this is the triumph of the photographic art and a boon to science."

Advantages of Gas in Private Houses. A Handy-Book for Gas Consumers: telling them what to do and what not to do. By J. O. N. Rutter, F.R.A.S. London: Virtue Brothers and Co. 1865.

In this little book the advantages of gas for lighting private dwellings are fully set forth, the management of it explained, and all the objections that have been made to its use either denied or the means pointed out by which they may be removed. One of the objections frequently alleged against gas is the heat and closeness it produces in small rooms, but, as the author justly observes, the quantity of heat produced by gas or candles is in proportion to the amount of light they give. If, where two candles were enough, gas is introduced that gives the light of twelve, the ventilation that answered in the former case will naturally be insufficient, and it should either be increased or less gas consumed. Most of the other objections are explained equally successfully, and with proper management it is shown that the danger of fire is far less with gas than when candles are employed. A careful perusal of this pamphlet may reassure those who at present hesitate about using gas on account of the danger or unhealthiness that has been attributed to it.

How to get over a Difficulty.—We quote the following from the *Medical Mirror*:—"For our own part, we are inclined to say about science and the Bible what the Mussulman said with reference to his Koran:—If science agrees with the Bible, science is superfluous, and may be destroyed, and if science goes against the Bible, it is pernicious, and must be destroyed."

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Kunst und Gewerbeblatt des Polytechnischen Vereins für das Konigreich Bayern. November and December, 1866.

Dr. Jünnemann "*On the Conversion of Tallow into Adipocire.*"—Dr. Schödler "*On the Removal of Iron Rust and other Stains from Textile Fabrics.*"—Dr. Winkler "*On the Influence of Rusting on Weights;*" "*On the Purification of Graphite.*"

Journal de Pharmacie et de Chimie. January, 1867.

Lefort "*On the Tinctorial Use and Value of Buckthorn Seeds.*"—Bellamy "*On the Use of Permanganate of Potassa as applied to Estimate Organic Matter in Water: Estimation of the Carbon in such Organic Matter.*"—Guibourt "*On Garou Bark.*"—Bert "*On the Separation of the Salts of Strychnia by means of Phenic Acid.*"—Ricker: "*Ferruginated Cod-liver Oil.*"

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

309. S. Plant and W. Tatton, Sutton, near Macclesfield, Cheshire, "An improvement in the manufacture of firelighters and artificial fuel."—Petition recorded Feb. 4, 1867.

250. E. V. L. Ebersburg, Montpellier Street, Knightsbridge, Middlesex, "A new or improved article of food for infants and invalids." Partly a communication from Baron J. von Liebig, Munich, Bavaria.—Jan. 30, 1867.

322. J. Ballonhey, Passavant, Haute Saone, France, "An improved process for vitrifying iron, cast-iron, and steel."—Feb. 5, 1867.

344. G. E. Pain, High Street, Camden Town, and C. Corroy, Dean Street, Soho, Middlesex, "Improvements in the preparation of oils for illuminating, lubricating, and other purposes for which they may be applicable."—Feb. 7, 1867.

425. J. Lamble, Southampton, "A new or improved composition for the coating and preservation of ships' bottoms."—Feb. 15, 1867.

Notices to Proceed.

2707. E. L. Simpson, Bridgeport, Fairfield, Conn., U. S. A., "An improved process for the preparation of india-rubber and kindred gums."

2709. A. Parkes, Birmingham, "Improvements in the manufacture of Parkesine, or compounds of pyroxylin, and in the production of imitations of ivory and pearl."—Petition recorded October 19, 1866.

3232. T. Gray, Wandsworth, Surrey, "Improvements in the preparation of bleaching materials or compounds." December 7, 1866.

3327. W. R. Lake, Southampton Buildings, Chancery Lane, "An improved mode of rendering paint uninflammable." A communication from J. B. Harris, Germantown, Kentucky, U. S. A.—December 18, 1866.

3359. C. Norrington, Plymouth, Devonshire, "Improvements in the treatment of substances containing phosphate of lime."—December 20, 1866.

3449. C. F. Flach, Call, Prussia, "Improvements in extracting silver from lead."—December 31, 1866.

2768. W. Weldon, Highgate, Middlesex, "An improved method of decomposing chloride of sodium and other compounds by means of steam."—Oct. 26, 1866.

309. S. Plant and W. Tatton, Sutton, near Macclesfield, Cheshire, "An improvement in the manufacture of fire-lighters and artificial fuel."—Feb. 4, 1867.

CORRESPONDENCE.

Organic Matter in Water.

To the Editor of the Chemical News.

Sir,—In reply to the last letter of your correspondent "B. J. G." on the above subject, I would submit that the objections he urges, with somewhat unnecessary warmth, against my suggestions, in no way invalidate the latter, being founded partly on a misconception of the object they were intended to serve, partly upon purely theoretical considerations.

Thus, with regard to the first of them, I must remind him that the question proposed was not the identification of "fresh albumen," but that of animal sewage, to which it is obvious that the word "fresh," in the sense in which it is used by him, and upon which the whole objection hangs, is totally inapplicable.

Again, I do not think he can seriously mean to bring forward "vegetable albumen" as a probable source of error, if the detection of ammonia or nitrates in a water be accepted as conclusive evidence of the access of animal sewage to it; though the existence of this, in common with certain other azotised bodies, in small proportion in plants, was precisely the point to which I referred as interfering with the theoretical accuracy of such an inference. As regards his fourth objection, it is surely possible that sewage received in the upper portions of streams may become so diluted on its downward passage as at last to form only an infinitesimal ingredient of the water; and this is all that appears to be implied in the reports upon the metropolitan waters at which your correspondent takes exception.

The whole subject of the employment of permanganate of potash for the proximate estimation of organic matter in water, including the acknowledged defects of the process, has been so exhaustively treated by its author in the paper to which reference was made in my last letter, that it would be superfluous, as well as presumptuous, on my part to enlarge upon it here; but it may be remarked, in answer to the concluding observations of your correspondent, that oxalic acid is evidently employed in it only as a convenient standard of oxidation, while it is apparently adopted in the above-mentioned reports as an exponent of results which would otherwise be unintelligible to a large majority of readers, and of which, since their value is confessedly rather comparative than absolute, the original terms are necessarily of minor importance.

I am, &c.

Thos. P. Blunt.

Chemical Notices from Foreign Sources.

Vapour Density.—A. Cahours finds, from recent researches on acetic acid and bodies allied to it, that if their vapour densities, taken at intervals of 5°, are represented by curves, these curves gradually approach the axes of their abscissæ, and finally run parallel to them, continue parallel for some distance, and then give place to fresh curves. Acetic acid gives at 350° four volumes, and at 440° notably smaller numbers, with incipient decomposition; in the interval of 110°—115°, between its boiling point and the point at which four volumes are first observed, different numbers are obtained, corresponding to no definite degrees of condensation, whilst in an interval of about 200° it follows the laws of gases, and the numbers correspond exactly to four volumes.

Formic acid, and the compounds of hydrocarbons with hydracids, possess, in truth, but one molecular grouping corresponding to four volumes, for the molecular groups represented by eight volumes, which are obtained at higher temperatures, are no longer in relation to the original molecules, but are referable to dissociation.

He asks what are the grounds for the assumption that the molecules of all bodies must necessarily give four vapour volumes, and remarks that ammonic cyanide, in which dissociation does not occur even at 1200°, gives at 100° numbers corresponding to eight volumes. So also phosphoric pentachloride, which boils at 160°—165°, gives at 170°—172° numbers far removed from four volumes. He concludes—1. That the molecule of a compound volatile body in the state of vapour corresponds to four or eight volumes; a molecular grouping corresponding to two or six volumes is possible, but is not yet proved to exist. 2. That a molecular grouping corresponding to three or six volumes does not exist in any bodies yet examined; for determinations made at temperatures 5° higher or lower than the points at which the numbers corresponding to such groups are obtained give different numbers.—(*Comptes R.*, lxiii. 14.)

Vapour Density.—Deville considers that the objections which many chemists have to admit that the equivalents of elements and compounds correspond to one and eight volumes, being grounded on analogies, are supported by little better than gratuitous hypotheses. He has, in conjunction with Troost, taken the vapour density of NH_4I,HgI at 350° and 440°, and obtained the numbers 6·49 and 6·38, the density calculated for eight volume being 6·44.

He fears lest, under the cloak of theory, vague ideas be introduced into chemistry, to the exceeding detriment of the science, and he concludes with the remark that, unless we make use of definite expressions and dismiss assumptions of unknown causes from our speculations, we shall be in danger of falling into the vagueness of mysticism.—(*Comptes R.*, lxiii. 18.)

Cyanogen, Chlorine Compounds of.—A. Gautier recommends the following method of preparing solid chloride of cyanogen without recourse to the liquid chloride:—A slow current of chlorine is passed through a solution of one part of cyanhydric acid in four parts of anhydrous ether. Viscid drops form on the sides of the vessel, and after twenty-four hours become crystalline groups. He finds that the solid chloride melts at 145° and solidifies at 130°. The bromide may be prepared in like manner.—(*Bull. Soc. Chim. Paris*, v. 403.)

Respiration, Experiments on.—Max von Pettenkofer and Karl Voit have made further experiments in the respiration apparatus described (*Ann. Chem. Pharm.*, Supp. 2), and find that more oxygen is absorbed during sleep than during the day, whilst less carbonic anhydride is given off by night than by day; during labour a man exhales much more carbonic anhydride and water than during repose (not sleep), but the amount of oxygen absorbed is the same on both days; however, during the night following the working day, a much greater than the normal quantity of oxygen is absorbed. It appears from these facts that the oxygen absorbed during sleep is stored up in the body for several hours, where it probably assists in a process of slow oxidation of the nutriment introduced into the body during the following day. Even during days of rest, the quantites of carbonic anhydride and water eliminated are greater than those which correspond to the quantity of oxygen absorbed during those days. The same quantities of carbonic anhydride are exhaled during the nights following working or resting days, and evidently result from the muscular movements made during sleep. In the night following working days, there is a great increase in the water given off by respiration and perspiration, serving, perhaps, to cool the muscles heated by labour.

The same quantity of urea is secreted in working as in resting days, showing that the work of the muscles is

performed without an increase in the decomposition of albuminoid substances.

These results confirm those obtained by Henneberg in 1865 when experimenting on oxen.

Experiments were also made on men suffering from diabetes mellitus and leukæmia lienalis. The patients always had excellent appetites, but, though fed on the most nutritive meats, were totally devoid of strength, nor were they refreshed by sleep. The same differences between the oxygen absorbed and the carbonic anhydride given off by day and night were observed in this case as were noticed when experimenting on healthy subjects.—(*Akad. München*, November 10, 1866.)

Carbonic Sulphides (C=12; O=16).—O. Loew describes a body C_4S obtained by acting upon acetic acid with phosphoric persulphide; it is insoluble in carbonic bisulphide, but dissolves with production of a red colour in concentrated sulphuric acid.—(*Zeitsch. Chem.*, N.S., iii. 20.)

Specific Heat of Graphite.—V. Regnault has determined the specific heat of several specimens of natural and artificial graphite. Graphite from Canada, No. 1, gave a mean number ·19866; from Canada, No. 2, mean ·20198; from Canada, No. 3, mean ·19113; from Siberia, mean ·19879. Graphite from gas retorts, after being heated white-hot, gave mean ·1968; the same kind of graphite, after being heated in a current of chlorine, gave ·2000, and that from Canada No. 3, after like treatment, gave ·1977. Hard burnt clay gave ·1940; therefore the ash in graphite (consisting principally of clay) has no appreciable effect on the results obtained. (*Ann. Chim. Phys.* [4], vii. 450.)

H. Kopp remarks on the above numbers that they are obtained by immersing the graphite heated up to 100° in the water of the calorimeter; that graphite is porous; therefore the heat given off by the water as it enters the pores of the substance reappears in the final result of the experiment. Regnault's numbers are higher than those obtained by Kopp.—(*Ann. Chem. Pharm.* cxii. 121.)

The Behaviour of some Minerals at a high Temperature.—Dr. L. Elsner has heated a great variety of minerals and other rock constituents in a porcelain furnace to an estimated temperature of 2500° to 3000°, and finds in general that silicates containing the alkaline metals, or iron, are much more fusible than those which contain much alumina, or no iron; with the exception of obsidian, all the rocks experimented upon, even those of volcanic origin, presented, after heating, totally different characteristics from those which accompany them in nature; the crystalline varieties became compact and semi-fused; therefore they must have been produced in nature under different conditions from those of his experiments. The conversion of pumice into an obsidian-like body is especially interesting. After heating, the rocks experimented on showed lower specific gravities.—(*Journ. prakt. Chem.*, xcix. 262.)

Tannic Acids.—Dr. R. Wagner distinguishes two varieties of tannic acid—the "pathological," in gall-nuts, ordinary tannin; the "physiological," in oak-bark, divi-divi, sumach, &c.—and gives the characteristic reactions of each variety; the physiological kind is alone fit for tanning purposes. He has examined all the known methods for the quantitative determination of physiological tannic acid, and, finding them all more or less unsatisfactory, proposes the following one, not indeed as perfect, but at least tolerable:—To a standard solution of neutral cinchonic sulphate in water, rosanilinic acetate is added in very small quantity; this solution is added from the burette to the tannic acid solution until the liquid above the precipitate of cinchonic tannate is coloured pink, which indicates the end of the reaction. —(*Journ. prakt. Chem.*, xcix. 294.)

Lactose.—Dr. Fudakowski, by acting upon pure sugar of milk with dilute sulphuric acid, separated it into two kinds of sugar; both are capable of undergoing fermentation, although the one kind, which has been before described by Pasteur, and crystallises in hexagonal plates, ferments more rapidly under like conditions than the other variety, which crystallises in right prisms, is less soluble in alcohol, and has a less sweet taste. Both turn the plane of polarisation to the right.—(*Med. Chem. Untersuchungen aus dem Lab. Tübingen*, 164.)

Curarine.—Dragendorff, to avoid the possible decomposition of the phospho-molybdate in the preparation of this body, proposes to evaporate to dryness, with the addition of glass powder, the alkaline solution from which the strychnine has been separated, extract the residue with alcohol of 95 per cent., add glass powder to the extract, again evaporate to dryness, take up with water, again evaporate to dryness, and finally extract the alkaloid with alcohol, which leaves it as a pale yellow residue.—(*Pharm. Journ. Russia*, 1866, 158.)

MISCELLANEOUS.

Chemical Society's Dinner.—The Secretary will be glad to hear at once from those Fellows who propose to attend the dinner on the 27th inst. and have not yet replied to his invitation, so that the necessary arrangements may be made.

Universal Pharmacopœia.—At the last meeting of the Pharmaceutical Society the Chairman stated that he had received an invitation to send delegates to Paris in August next for the purpose of compiling a universal Pharmacopœia. It seemed to be the general impression of the leading members present that it would be impossible to assimilate the whole of the Pharmacopœias.

Assay of Tannin.—Tannic acid, or tannin, is now employed in manufacture. Although no fraud has been effected, yet, by reason of the high price of this product, it is well to be able to test it easily. Tannin being soluble in ether, 1 gramme of tannin placed in the testing-tube, and covered with 10 grammes of ether, ought entirely to dissolve in it.—*Moniteur Scientifique.*

Composition and Quality of the Metropolitan Waters in February, 1867.—The following are the Returns of the Metropolitan Association of Medical Officers of Health:—

Names of Water Companies.	Total solid matter per gallon.	Loss by ignition.*	Oxidisable organic matter.†	Hardness.	
				Before boiling.	After boiling.
Thames Water Companies.	Grains.	Grns.	Grains.	Degs.	Degs.
Grand Junction	20·29	1·96	1·35	13·0	5·5
West Middlesex	20·00	2·00	1·81	13·0	5·0
Southwark & Vauxhall	20·00	2·14	1·92	13·0	5·0
Chelsea	20·17	1·75	1·18	13·0	5·0
Lambeth	20·47	1·99	1·61	13·0	5·0
Other Companies.					
Kent	27·41	1·25	0·08	16·5	9·0
New River	21·12	1·76	0·48	13·5	3·5
East London	22·75	2·50	0·80	13·5	5·0
Surface Wells.					
Bishopsgate Church	36·66	6·23	0·88	34·0	15·0
Fenchurch Street	85·93	7·23	0·40	16·0	7·0

* The loss by ignition represents a variety of volatile matters, as well as organic matter, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

† The oxidisable organic matter is determined by a standard solution of permanganate of potash, the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

HY. LETHEBY, M.B.

Electric Lamp for Miners.—Several attempts have been made in France to supply the electric light to the miner's lamp, and the following is a description of such lamp now made by M. Gaiffe, a philosophical instrument maker of Paris:—M. Gaiffe has availed himself of the curious effect produced by nitrogen and glass of uranium, which give the complementary colours rose and green, which united produce a white light rather more intense than that obtained by means of carbonic acid. M. Gaiffe's apparatus consists of a small bobbin, a pile, and a Geissler's tube, shown in the accompanying cut; the spirals T within the tube are formed of uranium glass, within which is pure and perfectly dry nitrogen. The spirals are contained within a tube of ordinary glass from which the air is exhausted, and the points are to be seen at the ends of the tube. The whole of this apparatus is enclosed in a very strong outer glass case E to prevent accidents; the mouth of the outer case is closed by means of an india-rubber cap C, through which the wires R, R pass, and these are covered with gutta-percha. The pile and bobbin are contained in a small box which is strapped knapsack-like on the miner's back, the conductors passing one beneath each arm. The pile is so enclosed as to allow the miner to assume almost any position without spilling the solution, and will work for eight or ten hours. The whole apparatus weighs seven pounds, and its present price is seventy francs. A similar lamp is used for under-water work; only in the latter case the conductors are longer, and the apparatus has a counterbalance to prevent its descending with too great rapidity.—*The Engineer.*

On Navassa Guano.—This material, which is found on the Island of Navassa, situated in the Caribbean Sea, is not, like the Peruvian guano, a product of birds, but a mineral, differing from apatite by not containing chlorine and fluorine, and by containing organic matter. A company at Baltimore, U. S., works the quarries, and subjoined is an analysis of the raw material by Dr. Ulex, at Hamburg:—Moisture, 1·6; organic matter, 10·4; SO_3, 31·2; lime, 34·5; CO_2, 3·3; alumina and peroxide of iron, 19·0: total 100·0. It is stated to be imported into England.—*Polytechnisches Centralblatt.*

Preservation of Meat.—On Friday last we were invited by Professor John Gamgee to meet the sub-committee of the Society of Arts on meat supply, and other persons interested in the question, at the Albert Veterinary College, Bayswater, for the purpose of witnessing the whole operation of preserving meat according to a process lately patented by Professor Gamgee. We are not at liberty at present to divulge the whole of the process, but we may state that, by a novel and apparently painless method of slaughter, the cattle are caused to undergo the preliminary pickling stage whilst *in articulo mortis*, and by this means the meat is endowed with the power of resisting decomposition and preserving its fresh pink colour for a period of five or six weeks. The completion of the process consists in packing the joints (containing bone, fat, skin, &c., just as they would be supplied by the butcher to customers) in an iron case, exhausting the air from it, and then filling up with a gas or vapour; after which the case is soldered down, and the preservative process is complete. The visitors saw an ox and a sheep killed by the new process, and then witnessed the process of packing, exhausting, filling with antiseptic vapour, and soldering down; the joints in the latter case having been cut from an ox and a sheep which had been killed on the previous Saturday in the presence of Dr. Miller and other leading chemists. Several of these cases were carried away by Mr. Le Neve Foster, Secretary of the Society of Arts, for the purpose of exposure for some time in artificially-heated rooms and subsequent examination. So little is the appearance or taste of the meat affected by the new method of killing, that, at Christmas last, joints of meat from animals so slaughtered were in great request at a butcher's in the neighbourhood, where they had been hung up experimentally. The length of time which meat so preserved will retain its fresh colour, appearance, and taste, has not been ascertained, but we examined a sirloin of beef killed early in November last, and were unable to distinguish it from fresh meat. The process is remarkably simple and easy to be carried out on the large scale. Experiments have now been in progress for a sufficient time and on a sufficiently large scale to test its practicability, and we believe that before long arrangements will be concluded for carrying Professor Gamgee's valuable discovery into operation in South America, Australia, as well as on the continent of Europe.

The Chemistry of Stock Feeding.—In the course of a lecture on the above, delivered to the Newbury Farmers' Club, Mr. Warrington, of the Royal Agricultural College, Cirencester, has given details of some original researches of great practical value, with an outline of the chemistry and physiology of nutrition, respiration, and muscular force. The question of obtaining the maximum mechanical work from an animal by judicious feeding was left untouched—we hope, only to be exhaustively treated on a future occasion. The following remarks apply to food as a means of increasing the animal frame. In the sheep are the following constituents:—

	Store Sheep.	Fat Sheep.	Very Fat Sheep.
Nitrogenous substances .	15·7	13·0	11·5
Fat	19·9	37·9	48·3
Mineral substances . .	3·4	3·0	3·1
Water	61·0	46·1	37·1
	100·0	100·0	100·0

It will be seen that as the fat progressively increases the nitrogenous substances and water decrease. The more rough and practical statement is—

Nitrogenous substances = muscle
Fat = fat
Mineral substances = bone,

being sufficient for stock-feeding considerations. The fat and muscle both increase, this increase ultimately having a much smaller proportion in a fat animal than in a lean one. Suppose the sheep weighs 100 lbs., and after fattening weighs 150 lbs., what is the composition of the 50 lbs. put on? Increase of a sheep while fattening—

Nitrogenous substances . .	7·5
Fat	63·0
Mineral substances . . .	2·0
Water	27·5
	100·0

The increase in other animals is very similar. The proportionate increase by bulk of the muscle will be different from that by weight, by reason of the association of the water with it. The animal economy is shown to be de-

structive, and the foods commonly used to supply aliment for animals have the following composition:—

	Swedes.	Meadow Hay.	Barley.	Beans.
Water	89·0	16·0	16·0	16·0
Nitrogenous substances .	1·4	9·6	10·6	25·3
Fatty matter . . .	·3	2·5	2·0	1·5
Sugar, starch, cellulose, &c.	7·8	41·7	64·7	49·6
Woody fibre . . .	·9	24·2	4·5	4·5
Mineral matter . .	·6	6·0	2·2	3·1
	100·0	100·0	100·0	100·0

How do these percentages determine the fattening of an animal? Take an animal not increasing in weight, what purposes does its food serve? 1. Renovation of tissue; 2. Production of muscular force; 3. Production of heat. To give an idea of the second series' demands, we must note that a vast deal of muscular work is done within the body. It has been calculated that the work of the human heart in one day would suffice to raise its own weight ninety miles, other muscles acting to preserve the various positions of the body. In the case now considered the whole of the food will be consumed in supplying these three requisites; all the nitrogen not so used requires evacuation as manure—is not stored up. The excess of fat is stored up. Mr. Warrington remarked that "if the chemist cannot imitate the constructive powers of a plant, neither can he imitate the destructive powers of an animal; he can only observe and admire." Excess of starch, sugar, &c., cannot be stored as such; they are converted into fat and so stored. The following experiment is interesting:—Two pigs from the same litter, and of almost equal weights, were taken; one was killed, and found to contain 22 lbs. of fat. The other was fed for ten weeks longer, and then killed; it yielded 78 lbs. of fat: 56 lbs. of fat had thus been stored up in the ten weeks; the food of the pig during this time had, however, contained only 14 lbs. of fat; 42 lbs. had thus been actually formed by the animal. It is possible, also, that nitrogenised food may form fat; as a result where an excess of nitrogenous food is supplied, a portion is stored up as muscle, wool, &c., while the excess of sugar and starch is converted into fat. It is important to remember that it is only the excess of food which is stored up as increase. Chemical calculations have likewise shown that two and a half parts of starch are about the smallest quantity from which one part of fat could be produced; two and a half is thus said to be the "starch equivalent" of fat. As would be expected, the manure from fattening animals is most valuable; about 90 per cent. of the nitrogen in the food appeared in the manure; the more nitrogenous the food, the more valuable the manure. In liberal feeding a larger proportion of the food is excess; liberal feeding is thus true economy. Fattening is most economical when done in the shortest time. An ox weighing 1000 lbs. or more has through its whole life to be kept at a temperature of about 98° Fahr. by the combustion of food, which costs the farmer a good deal, but as thus consumed makes no return; the sooner the animal can be made prime, the smaller is this expense. Experiments at Rothamsted have taught us that, even when an animal is fattening under favouring circumstances, one-half its food is consumed to supply heat, &c., and does not minister at all to the formation of increase. The whole of these considerations show that for the farmer to judge what is really the cheapest food in different states of the market, he must know the chemical composition of foods. We hope with Mr. Warrington that the time will not be far distant when farmers will be the philosophers that theoretically they should be.

On Solid Hydride of Phosphorus,* by M. Rudorff.—On dissolving biniodide of phosphorus in water, there is deposited, especially with the aid of heat, a yellow powder, which has hitherto been considered as more or less modified phosphorus. According to M. Rudorff, this powder is solid hydride of phosphorus, possessing all the characteristics which MM. Leverrier and P. Thenard have assigned to this compound. It is obtained in the proportion of about 2 per cent. of the biniodide of phosphorus employed, the yield being the same with hot as with cold water; however, with hot water the yellow is more decided. The author considers this the simplest and most expeditious way of obtaining pure hydride of phosphorus.

* *Ann. Phys. et Chem.* cxxviii. 473.

Meetings for the Week.

Monday, March 18.

Medical Society, 8 p.m.

Tuesday, March 19.

Royal Institution, 3 p.m. Rev. G. Henslow "*On the Practical Study of Botany.*"

Pathological Society, 8 p.m.

Anthropological Society, 8 p.m.

Wednesday, March 20.

Meteorological Society, 8 p.m.

Society of Arts, 8 p.m.

Geological Society, 8 p.m.

London Institution, 6½ p.m.

Thursday, March 21.

Royal Institution, 3 p.m. Professor Frankland "*On Coal Gas.*"

Royal Society, 8½ p.m.

Chemical Society, 8 p.m.

Friday, March 22.

Royal Institution, 8 p.m. Dr. J. Bell Pettigrew "*On the Various Modes of Flight in relation to Aeronautics.*"

Saturday, March 23.

Royal Institution, 3 p.m. Professor Frankland "*On Coal Gas.*"

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

J. Y. E.—Use caustic soda instead of potash.

Electro wishes to know the best and simplest method of coppering zinc by electrolysis. We know nothing better than the cyanide solution kept hot during the process.

Fittetienne.—We believe that no experiments have been yet published on the subject. Such a series would, however, be of considerable value at the present time.

Professor M.—Lithium is easily prepared by electrolysis of the fused chloride. It cannot be obtained in the same manner as potassium or sodium, owing to its non-volatility.

Rangoon Oil.—A correspondent would be glad to know the distinctive names and source of Rangoon oil, with tests and market price. The oil in question is used in the Government stores for greasing rifles and preserving them from rust.

W. Bell.—There has not been any work recently published containing the information you want, but valuable papers on the distillation of coal tar are plentifully scattered through scientific publications. Consult the several articles in Watts's Dictionary for the latest results.

M. James.—The alloy of copper 11, zinc 2, has the composition of "Dutch leaf gold." This is one of the most malleable alloys known, leaves of it having been beaten out to less than the fifty-thousandth of an inch in thickness. The other alloy—viz., copper 16, platinum 7, zinc 1—has the colour of 16-carat gold, and resists the nitric acid test.

A Constant Reader.—The rule to be adopted in these cases is to append the final *e* only to basic bodies, and to spell neutral substances without the *e*. Thus we write benzol, paraffin, &c.; aniline, strychnine, &c. This rule is, however, as often violated as observed.

J. Q.—Phosphorus dissolved in chloroform will be a more pleasant solution than when bisulphide of carbon is the solvent. Sufficient phosphorus will be present to ignite when the liquid is evaporated on paper.

Prussian Blue.—"Chromium" is requested to send his address to the office.

J. F. Dickson.—In our next.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Decomposition of Sulphate of Lead by Ammoniacal Gas, by George Farrer Rodwell, *F.C.S.*

Perfectly pure sulphate of lead was heated in a current of dry ammoniacal gas, and the products of the reaction were found to be subsulphide, and sulphide of lead, water, sulphite of ammonium, and free nitrogen.

The ammoniacal gas employed for the decomposition was washed by passing through a saturated solution of ammonia, and through two bottles containing a saturated solution of caustic potash, and it was dried by passing through tubes filled with small lumps of fused caustic potash. To the last of these tubes a piece of combustion tubing containing a weighed quantity of the sulphate was connected, and it was heated by means of a four-jet Bunsen burner. The sulphite of ammonium was retained by a thick plug of asbestos previously boiled in water, and strongly ignited; the water was collected in a tube filled with fused caustic potash, and the nitrogen was collected in a graduated tube standing over water, and afterwards measured.

The following are the most concordant results of a number of determinations:—

Pb_2S+PbS	H_2O
75·7330	18·7223
75·8426	18·2543
75·7763	18·8295
75·7662	18·6336
$(H_4N)_2SO_3$	N
10·8237	10·7673
10·3134	10·9921
10·9090	10·3538

Mean Results.

Pb_2S+PbS	75·7795
H_2O	18·6099
$(H_4N)_2SO_3$	10·6820
N	10·7044
	115·7758

From the above we see that the decomposition is effected by the action of 15·7758 parts of H_3N upon 100 parts of $PbSO_4$.

The above figures closely correspond with the following equation:—

$$7PbSO_4+20H_3N=$$
$$=3PbS+2Pb_2S+22H_2O+2[(H_4N)_2SO_3]+N_{16}.$$

which requires

Pb_2S+PbS	75·8603
H_2O	18·6704
$(H_4N)_2SO_3$	10·9382
N	10·5610
	116·0299

On the Determination of the Quality of Silver prepared by different Methods, by Professor Stas.

(Continued from page 111.)

After having heated to dull redness a certain quantity of each specimen of silver that I wished to compare, I weighed in the air 9·99943 grs. of each by means of platinum weights, which is equivalent to 10·0000 grs. of this metal in vacuo. I dissolved each assay in pure nitric acid of a specific gravity of 1·24. The solution was accomplished by placing the flask in a hot-air bath. To prevent the silver being carried off by the gases produced, I inclined the flask 40 or 45 degrees, and by means of a stopper of vulcanised india-rubber, desulphurated by a boiling solution of hydrate of sodium, I fitted on a bent tube having a bulb in the descending branch. The end of the tube dipped into the water contained in a little flask. The bulb was large enough to contain the liquid for washing the gas. I kept the temperature so low that the solution took place slowly—an absolutely indispensable condition when it is required to prevent the solution of silver being carried over by the disengaged nitric oxide.

The silver having been dissolved and the flask cooled, I inverted the tube so as to pour into the flask the washing water that had ascended into the bulb, and I then washed the matrass and the tube with pure water, taking care to add the liquid to the contents of the flask.

All the flasks were then carried into the dark room where the assay apparatus was fitted up. *All the surfaces in this dark room are covered with three layers of lump-black held in suspension by gelatine.* The room was lighted by gas, and a screen of yellow glass interposed between the flame and the objects which were to be lighted, and which are decomposed by white light.*

The flasks being surrounded by an envelope of india-rubber, I poured into each, under absolutely the same conditions of temperature, the liquid produced by the emptying, twice repeated, of the measurer filled with saline solution up to the o division.

In order to be certain that the temperature of the liquid contained in the measurer was exactly that of the bath that surrounded it, I took care to wait until the level in the capillary tube remained constant, as is the case with the liquid in a thermometer placed in a medium at a constant temperature; *it is for this reason that the calibrated capillary tube was joined on to the pipette.*

When I had closed the flasks, and shaken violently the liquid contained in them, I carried them successively into the *apparatus for titration*, in which I proceeded to examine the excess of silver or salt.

This apparatus is composed of a parallelopiped of wood 70 centimetres long, 22 broad, and 45 high, covered above with moveable boards, two of which have holes in the middle. Its interior is completely blackened, and separated into two compartments by a movable screen, furnished with a circular opening three centimetres in diameter. This opening allows to pass a cone of yellow light, proceeding from a spherical globe, which contains a solution of neutral chromate of sodium. Opposite the sphere is placed, at a suitable distance, a lamp of gas or petroleum (I have used both), the flame of which is so arranged that the brightest part of the luminous cone corresponds to the centre of the globe.

On the other side of the perforated screen is placed, likewise at a suitable distance, the flask containing the assay. I take care to raise or lower the flask, so that the surface of the liquid contained in it coincides exactly with the middle of the opening.

In examining the liquid either by the little sliding doors arranged in front of the apparatus, or by the little

* In mints, as in chemical laboratories, assays of the quality of silver take place in diffused light. *I venture to say that no exact determination is possible in this condition.* The comparative assays I have made leave me no doubt on this subject; still, the error that may thus be made does not sensibly influence the result, seeing the tolerably large limit within which it is given.

doors arranged at the side, we perceive that a section of a few centimetres only of the liquid is brilliantly illuminated, whilst the rest, together with the chloride at the bottom of the flask, is in complete darkness. The height of the illuminated section of the liquid depends upon the luminous cone, and the luminous cone depends both upon the diameter of the sphere and the relative position of the lamp and the flask with respect to the sphere. All turbidity, however slight, produced in the upper portion of the liquid by the formation of chloride of silver, is perceived; in fact, bodies suspended there become at once luminous. I have already shown, in my article of 1860, the appearance taken by the precipitated chloride of silver, according to the richness of the liquid in silver; I shall not revert to it. I will merely allow myself to repeat that, by means of this artifice, we can determine, in a few moments, a *twentieth of a milligramme* of silver in a litre of distilled water, and that, by waiting long enough (fifteen minutes), we can perceive and measure a *fiftieth* or even a *hundredth* of a milligramme in a quart of liquid, after having allowed to fall on its surface a solution of a chloride containing an equivalent quantity of chlorine. The smallest quantity of chloride of silver produced forms a kind of veil, which increases in thickness and brilliancy as the liquid added becomes mixed with that in the flask.

To determine the quantity of silver or of chloride of sodium not precipitated, I used normal solutions of pure salt and of silver. The measure I employed showed exactly *twenty drops* in a cubic centimetre of liquid. *One hundred thousandth* of silver was thus represented by *two drops*. Now, those who are sufficiently acquainted with the moist way know that *one* drop of normal liquid is enough to show the presence or absence of dissolved silver.

Here is the result of the assays of the silver prepared by different methods. I have added three assays of the silver prepared by Gay-Lussac's process, so as to show how powerless this method is to furnish the pure metal. I have, however, sufficiently noticed the fact of this impurity in my former work.

Quality of the Silver prepared by Different Methods.

(10·000 grs. of silver precipitated by 5·420 grs. of chloride of sodium.)

Method of Preparation of the Silver.	Weight of Chloride necessary for the precipitation of the Silver remaining dissolved.	Weight of the Silver necessary for the precipitation of the non-decomposed chloride.	Quality of the Silver, the distilled metal being 100·000.
FIRST SERIES.	grs.	grs.	
Electrolysis of cyanide of silver and ammonium; the metal fused by oxyhydrogen gas in a lime crucible and poured into water.	1.—0·00065 2.—0·00060	0·0000 0·0000	99·998
Reduction of ammoniacal nitrate of silver by pure sugar of milk and hydrate of potassium (M. von Liebig's process); fusion with borate and nitrate of sodium.	1.—0·00045 2.—0·00040	0·0000 0·0000	99·994
Reduction of the pure chloride by pure carbonate of sodium and nitre.	0·00045	0·0000	99·995
SECOND SERIES.			
Electrolysis of cyanide of silver and ammonium; metal fused by oxyhydrogen gas in a lime crucible and poured into water.	0·00065	0·0000	99·999
Reduction of the pure chloride with hydrate of potassium and sugar of milk; fusion with borate and nitrate of sodium.	0·00045	0·0000	99·995
Reduction of the pure chloride with pure hydrate of potassium and sugar of milk; fusion with borate and nitrate of sodium; refined in oxyhydrogen gas; poured into water.	0·00065	0·0000	99·999
Distillation of the refined silver produced by the reduction of the pure chloride by means of hydrate of potassium and sugar of milk.	1.—0·00075 2.—0·00070	0·0000 0·0000	100·000
THIRD SERIES.			
Electrolysis of cyanide of silver and ammonium; metal fused by oxyhydrogen gas in a lime crucible and poured into water.	0·00060	0·0000	99·997
Reduction of ammoniacal nitrate of silver by cuprous sulphite and sulphite of ammonium; metal fused in a lime crucible and poured into water.	0·00055	0·0000	99·997
Reduction from the chloride by means of charcoal and chalk (Gay-Lussac's process); one treatment.†	0·00000	0·0025	99·975
Reduction from the chloride by means of charcoal and chalk; two treatments.	0·00000	0·0016	99·984
Reduction from the chloride by means of charcoal and chalk; three treatments.	0·00000	0·0009	99·991

If we except the method of Gay-Lussac, we may admit that all the processes shown in my previous work, and those which I have described in this, when properly performed, furnish absolutely pure silver, provided we take care to submit the metal to a sort of refining by heating it to the boiling point in a lime crucible in the flame of oxyhydrogen gas.

† The silver experimented on is part of that which I assayed in 1857, and in which I found *directly* twenty-three hundred-thousandths of foreign matter, instead of twenty-five hundred-thousandths, as I now find.

Looking at the figures of the preceding table, the constancy of the results obtained from the same metal is noticeable. In the three series of determinations I had each time to renew the saline liquid, on account of the insufficiency of the capacity of the reservoir; but in each series it is the same chloride and the same silver, that obtained by electrolysis, that have served as a type of comparison. The results have been identical. We may, then, assert that, by operating under suitable conditions—which I have sufficiently pointed out—it is possible to seize the exact moment when the *complete elimination* of the dissolved silver is accomplished; there is no doubt that the method of the moist way, for the *comparison* of different silvers with each other, gives results almost mathematically exact.

When, for the determinations set forth in this work, I have had to measure the quantity of silver, or of chlorine, of bromine, or of iodine existing in a liquid in which I had formed either a chloride, a bromide, or an iodide of silver, I performed this measurement in conditions identical with those I have just described on the subject of the determination of the quality of silver, and took the same care in it. The results therefore deserve the same confidence.

After having shown the methods I employed to procure pure silver, I will now relate the means I employed to prepare the chloride of ammonium, to be used in the determination of the proportional relation of this metal with chlorine.

TECHNICAL CHEMISTRY.

The Theory and Working of Blast Furnaces, by Wm. Crossley, *F.C.S., Manager Ormesby Iron Works.**

(*Concluded from page* 124.)

Another point to which I will direct your attention is the utilisation of blast furnace gas, whereby most firms have been enabled to do away altogether with the use of coal either for stoves or boilers. Furnace gas, as I have stated before, is a mixture of carbonic oxide (carbon combined with only half the full quantity of oxygen it is capable of combining with), free nitrogen, and the carbonic acid driven off from the limestone. The greatest difficulty in dealing with it seems to be owing to its great bulk, and the impossibility from ordinary observation of telling when it is completely oxidised; and as from calculation it would seem that we have not yet succeeded in utilising all the heat it is capable of evolving, some easy means for determining the best way of burning the gas, so that it does not take a large portion of heat up the stack with it, or else escape without perfect combustion having taken place is to be desired. I have made the following calculation based on the units of heat evolved by the combustion of 1 lb. of carbonic acid and 1 lb. of coal.

Taking the average coke used in the district at 25 cwt. to the ton of iron made, and the make of iron at 250 tons per furnace per week, there will be produced 729 tons of carbonic oxide, 163 of which will be oxidised by the oxygen in the iron ore into carbonic acid, leaving 556 tons as evolved from each furnace per week. The above, when properly consumed, should do the work of 206 tons of coal. I am quite aware that this carbonic oxide is mixed, 1664 tons of nitrogen and 331 tons of carbonic acid, but as this should not enter the stack at a higher temperature than it leaves the furnace, it ought not materially to affect the result; but, for the sake of discussing the matter fairly, let us allow something for this. To reduce the quantity to 180 tons of coal as its equivalent per week, I am sure, is ample; and I ask, is the gas from each furnace in the best arrangement at present at work doing the work of 180 tons of coal? If not, what direction ought any experiments to take for more fully utilising the furnace gas? I have already said that the principal thing is the proper admission of air, and some means of doing this is what we most want. I submit the following as my idea of the matter. By taking into consideration the composition of furnace gas, the composition of atmospheric air, and the quantity of oxygen required to fully oxidise the carbonic oxide, I find—after making due allowance for the gas being expanded by heat—that rather under one part of atmospheric air is required for the proper combustion of three parts furnace gas; and hence, if the gas was not forced into the stoves or under the boiler by the back pressure in the gas main, this would be about the proper proportion between the air inlet and the gas inlet valves, and, corrected for the back pressure, I do not know if this will not be the best means of regulating it. This leads us to the next point—viz., the direction in which any further efforts made for the better working of blast furnaces ought to tend.

1. There is a still further increase in temperature of blast.

The advantages of increased temperature of blast pointed out by Mr. Cochrane, to which I have referred, are not the maximum of what can be obtained. There cannot be the slightest doubt but that a further increase still will lead to increased saving in fuel, to increased make of iron, and probably to improved quality of iron; for we must remember that the hot blast, by decreasing the quantity of fuel to a given result, also decreases the quantity of sulphur and other impurities passing through the furnaces. Dr. Clarke, at the Clyde Iron Works, found that increasing the temperature of the blast from atmospheric temperature to 600° F. reduced the sulphur passing through the furnace in a given time from 2·57 tons to ·72 ton. When we consider the injurious effect on iron of even a very small quantity of sulphur, this fact ought surely to be worth taking into consideration, especially as the decrease in sulphur also involves other two important results—viz., the furnace is able to carry a heavier load, and to work with less limestone, for it is well known that a large excess of limestone is used, and comes away in the slag, over and above what is requisite to flux the siliceous and earthy matter contained in the stone.

Theoretically, I think the decrease in fuel used in the furnace will at any rate be equivalent to four times any fuel used outside for heating the blast until a temperature of blast is attained equal to the temperature of the furnace itself. There are, of course, many other things besides temperature to be considered, which may ultimately neutralise in other ways the good to be gained by very high temperatures; but I think we may safely aim at a much higher temperature than is at present obtained.

Lastly, knowing the great loss of heat we suffer by burning the coke into carbonic oxide, ought we not to consider if some other form of furnace will not answer much better, and have the effect of enabling us to form the higher oxide of carbon? The number of furnaces and modifications of furnaces that have been suggested with a view of doing this are innumerable—their name truly is legion—but past failure should not make us despond.

* Communicated by the author.

The numerous efforts that have been made in this direction show that something else is desired and believed in, and in the end we may succeed.

The following is, in my opinion, theoretically the proper form of furnace. The coke or coal is put into the hearth by means of a separate shaft, which shaft is so closed that at no time is there any current of gas through it. The blast is forced in through ordinary tuyeres, as at present, and the greatest intensity of heat is produced in the hearth where it is supposed to be most wanted. The hot gases pass into the main shaft containing limestone and ironstone, and after reaching a certain point it is ignited and kept in combustion by another jet of blast. By this means the gas is fully oxidised, and gives out its maximum of heat. The ironstone and limestone are tipped into the main shaft directly from the wagons in which they are received. The first effect on them will be to drive off the volatile matter and the carbonic acid, and as an excess of air can be forced into the upper tuyeres, the iron would probably be peroxidised. Lower down in the furnace the temperature of the ignited gas will probably be sufficient to melt the mixture; lower still, the iron in the melted mass would be reduced by passing through the atmosphere of carbonic oxide, and in the hearth itself would meet with the requisite carbon and intensity of heat to convert it into cast-iron. Although I say this is theoretically the proper form of furnace, and our efforts ought to tend to make it practicable, yet no one sees its present impracticableness, in some respects, more than myself, and I am prepared to criticise it as keenly as any one, but still I feel certain that if ever we do away with our present wasteful system of making iron it must be by some such furnace, and hence I draw attention to it, and ask for a thoughtful consideration of its claims.

On the Estimation of the Purity of Commercial Picric Acid, by John Casthelaz.

There were to be found in commerce last year, and, undoubtedly, are still, picric acids of all kinds and qualities. They are distinguished as—

Crystallised picric acid No. 1.	Picric acid in paste No. 1.
,, ,, No. 2.	,, ,, No. 2.
,, in massed crystals.	,, ,, No. 3.

In such conditions, what must the lowest scale of products be?

In order to avoid any confusion, would it not be preferable to prepare only two kinds of picric acid, both as pure as they can be obtained in an industrial manufacture—

Pure crystallised picric acid,

Pure pulvulerent picric acid?

I have adopted these two types; other manufacturers will do the same, and I am persuaded that before long they alone will figure in commerce.

I thought it would be convenient, both for the maker and the consumer, to have a small apparatus which would permit them, in a few moments, to assure themselves of the state of purity of a picric acid. I have therefore combined in the same box graduated tubes, mortar, pestle, scales, reagents, types, &c. This *ensemble* constitutes the picricometer of John Casthelaz.

Pure Picric Acid.—Picric acid is one of the most important derivatives of phenic acid; its scientific name of trinitrophenic acid shows, at the same time, its production and composition.

Obtained by the reaction of three equivalents of nitric acid on one equivalent of phenic acid, picric acid has for formula $C_{12}H_2(NO_4)_3,HO$.

Picric acid, as its name indicates, has a bitter and insufferable taste; more soluble in hot than cold water, it crystallises in flakes or into small prismatic crystals with a rhomboidal base, and of a beautiful pale yellow colour.

Picric acid, submitted to heat, partly melts and sublimes without alteration. Heated rapidly in the open air, it kindles without explosion and burns, leaving a carbonaceous residue; heated quickly, it detonates. Hydrochloric, nitric, and sulphuric acids are without action on it.

Picric acid unites with bases, and in general gives yellow salts, all more or less soluble. This will be spoken of more at length in the assay of picric acid by the wet way.

Lastly, picric acid dissolves easily in alcohol, in ether as well as in benzol.

It is on these latter properties of picric acid—on its, solubility in ether or in benzol—that the assay of picric acid, by means of the picricometer, is based.

Impurities of Picric Acids.—The impurities which are met with in commercial picric acids are of two kinds:—

1st. Accidental impurities.

2nd. Added impurities.

The first proceed from imperfection in the manufacture, the second from sophistication or additions.

Accidental Impurities.—They are due, it may be, to the agents employed in the manufacture of picric acid, to incomplete reactions, or to other causes which we are about to point out:—

1. If impure phenic acid containing neutral oils has been used, the picric acid will be accompanied by foreign nitro-compounds, which are distinguished by their insolubility in water.

2. If the reaction of nitric acid on phenic acid has not been complete, the picric acid may equally contain products insoluble in water. It will also contain nitrophenic or binitrophenic acids, which give, in tincture, a less clear and lively shade than picric acid.

3. If the picric acid in paste has not been well washed or well drained, it may contain water and nitrous acid.

4. If the reaction of nitric acid on phenic acid or certain oils which accompany it, has been too quick, or pushed too far by heat, the picric acid may contain oxalic acid. The case is rare. Oxalic acid, which is sometimes found associated with crystallised picric acid, may very often enter also into the category of added impurities.

The traces of sulphuric or hydrochloric acid which commercial nitric acids contain, disappear with washing, and attention need not be paid to them.

Additional Impurities.—These are the most important to discover and point out.

If, in phenic acid (manufactured from these two products, nitric acid and phenol), considerable quantities of sulphate of soda, nitrate of soda, chloride of sodium, alum, &c., are found, it is not very probable that these impurities proceed from the manufacture; they must have been directly added to the picric acid.

Principles of the Picricometer.—Pure picric acid being soluble in ether and benzol, the impurities described being little soluble or insoluble in these two solvents, a simple, prompt, and easy method of separating them follows. In treating picric acid with twenty times its weight of rectified ether, or with benzol in excess, picric

acid is dissolved; the impurities, oxalic acid, alum, salts, &c., remain insoluble.

The apparatus consists of a graduated tube contracted at the lower part. The tube which follows the contracted space is divided into four parts, each able to contain five grammes of ether, in the whole twenty grammes. The tube is stoppered to avoid the evaporation of the solvent. The manner of proceeding to test picric acid by ether, by means of the picricometer, is very simple. It is sufficient to take as uniform a sample as possible of the picric acid to be tested, to mix and pulverise the said acid, to weigh one gramme of it and place it in the picricometer, then to pour ether up to the fourth division, or a quantity of twenty grammes, afterwards to shake for a few moments. If the picric acid is pure, it will entirely dissolve in the ether; if the acid is adulterated, the insoluble impurities will settle in the lower part of the tube, and it will be easy to estimate their proportions.

If it is thought desirable to proceed more exactly, and to weigh the insoluble deposit, it is advisable to wash it with 5 grm. of ether, and to repeat this washing a second time in order to remove the last traces of picric acid. After this it will be easy to determine the nature of the insoluble deposit by the ordinary methods of analysis.

Test of Picric Acid by Benzol.—MM. Depouilly, to whom I had pointed out the mode of testing picric acid by ether, recommend the test by means of benzol in the two following cases:—

1st. When we wish to prove the presence of water, of liquid mineral acid (principally nitric acid), or a hydrated salt which may contain picric acid.

2nd. When we wish to estimate more certainly the quantity of oxalic acid.

Indeed, oxalic acid, although slightly soluble in ether, is completely insoluble in benzol. Benzol neither dissolving the soda salts formerly described nor alum, these latter remain insoluble, and are precipitated, as in the test by ether. Benzol is not so good a solvent of picric acid as ether, and it must be slightly warmed in order to facilitate solution. Under these circumstances it is better to operate only on a half-gram of the product to be tested, and to immerse the testing tube into warm water to aid the solution of the picric acid.

Test of Picric Acid by the Wet Way.—Picrates are, in general, very soluble. Picrates of soda, lime, barytes, iron, binoxide of mercury and of silver are very soluble.

The least soluble picrates are those of lead, protoxide of mercury, and potash.

The difference of solubility of picrate of potash and picrate of soda, furnishes an excellent means of discovering and distinguishing potash from soda salts.

Solution of picric acid, poured into a solution of a salt of potash, immediately gives a yellow precipitate of picrate of potash.

Solution of picric acid may easily be tested for sulphuric, oxalic, and hydrochloric acid, by adding to it solution of picrates of baryta, lime, and silver.

A picric acid, pure by these reagents, may still contain nitrates, but these salts will be revealed by the test with ether by means of the picricometer.

The results obtained by the wet way are thus useful as a control to the indications of the picricometer, and when these modes of experiment are better known and adopted, commercial picric acids will no longer be liable to contain these additional impurities, which it is of so much importance to the consumer to discover and remove.

PHYSICAL SCIENCE.

On a Magneto-electric Machine, by* W. Ladd.

In June, 1864, I received from Mr. Wilde a small magneto-electric machine consisting of a Siemens' armature and six magnets. This I endeavoured to improve upon, my object being to get a cheap machine for blasting with Abel's fuzes. This was attempted by making one with circular magnets and a Siemens' armature, revolving directly between the poles, the armature forming a part of the circle; with this I could send a very considerable power into an electro-magnet, &c. It was then suggested to me by my assistant that if the armature had two wires instead of one, the current of one being sent through a wire surrounding the magnets, their power would be augmented, and a considerable current might be obtained from the other wire available for external work; or there might be two armatures, one to exalt the power of the magnets, and the other made available for blasting or other purposes. Want of time has prevented me carrying this out until now; but after the interesting papers of C. W. Siemens, F.R.S., and Professor Wheatstone, F.R.S., were read last month, I have carried out the idea as follows:—Two bars of soft iron, measuring $7\frac{1}{2}$ in. × $2\frac{1}{2}$ in. × $\frac{1}{2}$ in., are each wound round the centre portions with about thirty yards of No. 10 copper wire, and shoes of soft iron so attached at each end that when the bars are placed one above the other there will be a space left between the opposite shoes in which a Siemens' armature can rotate. On each of the armatures is wound about ten yards of No. 14 copper wire, cotton-covered. The current generated in one of the armatures is always in connexion with the electro-magnet; and the current from the second armature, being perfectly free, can be used for any purpose for which it may be required. The machine is, altogether, rudely constructed, and is only intended to illustrate the principle; but with this small machine three inches of platinum wire ·01 can be made incandescent.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, March 19, 1867.

The experiments on the electric light commenced on board the *Jerome Napoleon* yacht, under the direction of M. Georgette Dubuisson, captain of the frigate, and with the concurrence of M. Auguste Berlioz, director of the "Alliance" Company, have already given satisfactory results, especially as regards the possibility of avoiding collisions at sea, the cause of the loss of so many vessels. Besides the ordinary lighting-up apparatus, trials will shortly take place with light condensers, by the aid of which M. Louis d'Henry, demonstrator of physics at the Faculty of Sciences at Lille, was the first to put in use, and thus resolve, the following problem:—Being given a luminous point, *to contrive an apparatus which receives on its surface all the light emanating from that point, and directs it towards a position in space.* The condenser which is to be tried at Havre is composed of an ellipsoid of revolution, by means of which the light placed in one of the foci undergoes three reflections, and is projected sixteen times more intense than the direct pencil of rays. We can thus comprehend, in operating with the electric light equal to 100 or 200 gas burners, the effect that would be

* Communicated by the author, having been read before the Royal Society, March 14, 1867.

produced by sixteen times this light directed and convergent on a given point.

A company has been formed in Paris by the firm of Jos. de Susini and Co., with a capital of 80,000*l.*, for the general fabrication of oxygen gas by the process of M. Archereau. This process consists in the decomposition of sulphuric acid by heat or by special apparatus invented and patented by M. Archereau. The result of the decomposition is a mixture of oxygen and sulphurous acid; the latter is separated either by chemical absorption or by the compression of the two gases, causing the liquefaction of the sulphurous acid, which is allowed to escape by a stop-cock placed in the lower part of the recipient. This acid is newly converted into sulphuric acid by its injection into leaden chambers. With 11 kilogrammes of sulphuric acid at 60° a cubic metre of oxygen is formed. The conversion into sulphuric acid of the sulphurous acid proceeding from the decomposition would cost about 25 centimes, and the cost per cubic metre of oxygen gas thus produced would not exceed in any case 85 centimes. The fact upon which M. Archereau founds the enormous profits of the company is as follows:—The illumination, resulting from the combustion of two cubic metres of common gas and one cubic metre of oxygen, is equal in intensity to that of plain air combustion of sixteen cubic metres of ordinary bicarburetted gas. The former, two metres of gas and one of oxygen, would cost at most 1 fr. 45 c.; the second, sixteen cubic metres of gas, at the Paris price of 30 centimes the cubic metre (about 7*s.* the thousand feet), 4 fr. 50 c. There remains, then, a difference of 3 fr. 35 c. to be shared between the consumer and the producer of the superoxygenated gas for each sixteen cubic metres of gas consumed at the present day in Paris.

Nothing proves to us yet that the production of oxygenated gas by the decomposition of sulphuric acid or even sulphate of lime and the liquefaction of the sulphurous acid gas, brought back again to the state of sulphuric acid, is an industrial operation as easy and as economical as the prospectus, which we have before us, states. But it is certain, for it has been tried on a large scale at Sarrebruck, that the process of Messrs. Tessié de Mothay and Maréchier, of Metz—the superoxidation of the manganate of soda by a current of hot air, and the deoxidation of the permanganate by a current of steam—give all the excellent results expected. Each kilogramme of manganate gives off 85 litres of oxygen gas; the loss in each operation is almost nothing, and the price of each cubic metre of gas does not exceed half a franc. In a few days the apparatus of our friends will be installed in the Champ de Mars, on the grounds of the Exhibition, in a laboratory quite close to our lecture-hall. During the whole of the Exhibition they will work so as to furnish five cubic metres of gas per day, which will be partly utilised for the illumination of our hall by admixture either with the common gas or with the gas derived from the spontaneous contact of the air with the essences of petroleum in the gas apparatus of M. Mille, and the projection of the inflamed jet of the two gases on the magnesia of the lamp of M. Carlevaris, of Genoa. This lamp has been now greatly improved: for the lime cylinders of the Drummond light the learned Professor substitutes thin plates formed of magnesia and chloride of magnesium, which he places singly in small lamps, but grouped in a cylindrical form in lighthouses, &c., and which have the great advantage of being transparent, also of throwing intense light in the four directions. We tried one of these new lamps at a lecture given at the Agricultural Club in the Rue de Baune, and it produced wonderful effects; it is a complete revolution in the system of the Drummond light.

As we are on the subject of oxygen, justice compels us to remark an error which escaped our notice. We said a word, in our report of the Academy of Sciences, of the process of the distinguished chemist M. Mallet, founded on the property possessed, by the protochloride of copper Cu_2Cl, of absorbing the oxygen of the air and of being changed into the oxychloride $CuCl,CuO$, susceptible, when it is heated to a temperature of 400° C., of parting with this oxygen and returning to the state of protochloride, and so on. We understood from the remarks of M. Dumas, who presented the note of M. Mallet to the Academy, that, to remove the oxygen from the oxychloride, M. Mallet had recourse to steam, like M. Tessié de Mothay. This is not the case. The oxygen is driven off by the sole action of heat, which does not exceed that of the decomposition of chlorate of potash, and permits operations to be carried on, upon a small scale, in glass vessels. A kilogramme of protochloride alternately oxidised by a current of hot air and deoxidised by heat gives out 28 to 30 litres of oxygen gas without any appreciable loss of substance. We remark the difference, 46 litres, of oxygen gas furnished by a kilogramme of manganate, and 30 litres obtained by a kilogramme of protochloride. Also we remark especially the difference of the process of M. Archereau, which requires to be treated by enormous pressures for the mix ture of oxygen and sulphurous acid, and the processes either of M. Tessié de Mothay or M. Mallet, which do not require condensation or refrigeration, but yield only a simple mixture of steam and oxygen or of heated oxygen.

Before quitting this subject, let us announce that all those having recourse to the Drummond light are obliged to use, when they have no gasometers, india-rubber bags (at least on the Continent), which are expensive and treacherous; a simple pinhole renders them unserviceable. They can obtain the air-sacks invented by M. Galibert, of 111, Boulevart de Sébastopol, Paris, of whom we spoke in one of our last articles, and whose patent respirator for preserving life in noxious vapours is sold by the Patent Invention Company, No. 45, Little Britain, London. Constructed of two strong pieces of cloth, each having received on the inside layers of india-rubber varnish, which can be increased to any number, and strongly pressed together, these sacks of 13 to 33 gallons and more can serve perfectly for containing and transporting air, oxygen gas, &c., without any perceptible loss for some days. Neither have they the bad odour of india-rubber sacks, and consequently communicating none to the gas which escapes. The recipients which serve for the inhalation of oxygen gas or protoxide of nitrogen should henceforth be constructed of Galibert's impermeable cloth. India-rubber bags should be forthwith abandoned. Also it is well to remember that the experiments of Mr. Graham prove that india-rubber yields readily to the diffusion of gases. If, for example, we fill one with gas, the air enters and renders it more and more explosive.

We have the best possible news of the trials that are being made at Lille of the process of cold bleaching by permanganate of soda and hyposulphite of soda. The question at the present day seems to have been completely resolved. It may perhaps be recollected by our readers that the solution of hyposulphite of soda and the manganate should receive in addition a small quantity of hydrofluosilicic acid. This, consequently, had to be produced in large quantities, the more necessarily as it is imperatively requisite for the new processes of dull engraving on glass, for which a great future success is reserved.

Now we learn that M. Tessié de Mothay has succeeded in preparing, on as large a scale as is required in treating by heat in large furnaces, a mixture of fluate of lime, sand, and other substances adapted to render the reaction or the reduction more easy. When this acid is produced abundantly and economically, the great industry of soda will completely enter upon a new career. We purpose returning to this great discovery, of which we only now give a slight sketch.

Let us mention another success. M. Lantier, formerly a simple shoemaker, but whom an irresistible vocation drew into the science of electricity, and who has already

distinguished himself by the construction of a regulator and by the fabrication of artificial carbons for the electric light, is at present occupied in the solution of two great questions—1. To construct magneto-electric machines with a power two or even four times greater than those of the Alliance Company, or even the machines of Mr. Wilde, without the excessive velocity of the armatures of the latter, and without increasing the force necessary to put them in motion; 2. A burner of the electric light being given, to divide it into two, three, or four other burners without additional motive power, and by the simple addition of new regulators in communication with a common circuit. Aided by the support of one of my young brother labourers, M. Lantier has been able to construct the necessary apparatus, and they will figure at the Universal Exhibition. Let us not forget to say that, on his part, M. Van Malderen, the able director of the workshops of the Rue du Puits Artésien, Passy, to whom the magneto-electric machine of the Alliance Company owes its actual admirable qualities, is actively occupied in perfecting them, in spite of the challenge given by Messrs. Wilde, Wheatstone, Siemens, Lantier, &c.

The success of the *Mille* gas-lamp, with its double envelope and absorbing sponge, exceeds all expectations. They are sold by thousands.

The writer here wishes to remind the readers of the Chemical News, as well as all the *savants* and manufacturers in England, that he places himself entirely at their disposal to exhibit, defend, and make known their rights. Our lecture-hall at the Exhibition, our lectures, pen, influence, &c., will be available for them. In order not to sink under the pressure of so much toil, we have secured the services of learned and devoted co-operators, of which we shall soon publish a list. We are ready prepared to answer all appeals made to us. F. Moigno.

PROCEEDINGS OF SOCIETIES.

ROYAL INSTITUTION.

A Course of Six Lectures "*On Coal Gas*," by Dr. Frankland, F.R.S. (Lectures III. and IV.—March 14 and 16, 1867.)

Construction and Use of Photometers—Gas-burners—Conditions necessary for obtaining a Maximum Amount of Light in the Consumption of Gas—The Constituents of Crude Coal Gas—Impurities—Diluents—Illuminants.

The subject which was commenced in the last lecture—the measurement of the illuminating power of flames—was continued. The method of using a gas-meter during photometric experiments, for the measurement of the quantity of gas consumed, was shown, and the various kinds of jets from which gas might be burnt were examined. When gas was first introduced it was burnt from a single jet, and a flame from such a jet was made to burn on the lecture table. An experiment was then made, showing how the idea of the fishtail burner originated. Two flames burning from single jets, when brought in proper position, produced a fishtail flame, This was an important improvement in the method of burning gas; a table exhibiting the difference in the amount of light yielded by the same amount of gas when burning from single jets, and when burning from combined jets, showed that upwards of 50 per cent. more light was given by the latter. Dr. Frankland attributed the increase in light in gas burnt from a fishtail jet over the same amount burnt from a single jet, to the lessening of the velocity at which the hydrocarbons pass through the flame, caused by the striking in opposing directions of the two single flames. A number of argand lamps were exhibited: amongst them Leslie's, in which the burner consists of a circle of fine jets. Gas burnt in this lamp gives more light than when burnt in any of the ordinary forms of gas-lamps. It is therefore used by gas-manufacturers when testing the luminosity of the gas they supply; as, by burning the gas from it, they are enabled to record the light as equal to twelve candles (the standard fixed by Act of Parliament); the same gas, when burnt from ordinary jets, yielding a light equal only to ten candles. The conditions upon which obtaining the maximum amount of luminosity from a given amount of gas is dependent were described as the following:—1. Access of atmospheric air; 2. Velocity at which the hydrocarbons are driven through the flame; 3. Density of the atmosphere as measured by the barometer.

The lecturer then made an experiment to show the effect which an admixture of atmospheric air with coal gas had on the luminosity. Three flames were placed on the table: one burning cannel gas, another the same with 10 per cent. of air, and the third with 40 per cent. of air. The effect was striking, and showed that the admixture of air greatly decreases the illuminating power. It was mentioned that Professor Erdmann, of Leipsic, had made this property of admixed air a means of determining the illuminating power of coal gas, the value of the gas under examination being determined by the amount of air necessary to nullify its luminous effect. The lecturer explained that this action of air was due chiefly to the cooling effect it exercised in passing through the flame.

A little device for increasing the light given by a gas flame was here shown, invented by Mr. Scholl, and termed the "Platinum Perfecter." Some flames were tried with these perfecters, and the results were certainly astonishing. Dr. Frankland offered an explanation of their action. He believed that flames with them yielded more light than ordinary flames, in the same way that fishtail flames yielded more light than flames from single jets—that is, by the diminution of the velocity with which the hydrocarbon gases are driven through the flame. An experiment to show the effect of atmospheric pressure was made. A flame was burnt under a receiver, and as the air was gradually exhausted the flame gave less light. The converse experiment of condensing the air in the receiver showed that the flame under these circumstances became more luminous. The fact that atmospheric pressure influences the amount of light was thus made evident, and the decrease or increase in illuminating power was stated to be directly proportional to the atmospheric pressure. Other experiments relating to atmospheric pressure were the following:—1. A mixture of hydrogen and oxygen at the ordinary pressure was exploded in a closed eudiometer. Since these gases expand at the moment of ignition to about ten times their ordinary volume, they were under a pressure of about ten atmospheres. A brilliant flash resulted. 2. A similar mixture was exhausted to a pressure of only $\frac{1}{10}$th of an atmosphere, so that at the moment of ignition about the ordinary pressure of the atmosphere would be obtained. The light, when the current was passed, was very feeble, with the theatre darkened. 3. A mixture of hydrogen and common air was condensed so as to contain the same amount of oxygen as in the first experiment. The flash was about equal in brilliancy to that obtained in Experiment 1.

The effect of temperature upon the illuminating power of flames was again brought forward. An argand flame was burnt first in atmospheric air; afterwards it was partially fed with oxygen; the luminosity was considerably increased. The luminosity of ignited carbon at three different temperatures was compared—carbon ignited by a hydrogen flame; secondly, as in the preceding, with the addition of a stream of oxygen; and, thirdly, carbon points ignited by a voltaic current. In demonstration of the same fact, lime was heated in a hydrogen flame, and this was subsequently fed by a stream of oxygen.

The following methods of increasing the light of a coal-gas flame were given:—1. By feeding the flame with oxygen. 2. By decreasing the abstraction of heat from

the flame. 3. By heating the gases before they enter into combination. The increase in luminosity obtained by the last of these methods was illustrated by making both the coal-gas and air pass through a charcoal furnace before they came in contact. A lamp was shown in operation, where the same process was employed. It was constructed on the argand principle. Direct ingress of air below the flame was prevented by a glass plate, and by two glass cylinders a current of air passing in at the top of the outer one was maintained.

Air was burnt in an atmosphere of coal-gas, and attention was drawn to its slight luminosity. The experiment was afterwards made with two jets of air burning close to each other; a very good light was then obtained, and the following explanation was given:—In the combustion of coal-gas in air there are two radiating surfaces—the combustion of the hydrogen with the air, and that of the carbon. In the reverse experiment the flame possesses only one radiating surface, and thus the increase in light when two jets were made to burn close together. The subject of the constituents of coal-gas was then entered into. They were divided into impurities, diluents, and illuminants. Sulphuretted hydrogen, chloro-sulphur compounds, ammonia, carbonic acid, and bisulphide of carbon came in the first class; in the second, hydrogen, carbonic oxide, and marsh-gas; in the third, olefiant gas, butylene, vapours of hydrocarbons, propylene, and acetylene.

An experiment illustrative of the manner in which sulphuretted hydrogen is formed in the manufacture of coal-gas was then made. Hydrogen, being one of the products of the decomposition of coal by heat, was passed over sulphide of iron (which would represent the pyrites found in coal) heated in a bulb tube, and the presence of sulphuretted hydrogen shown by the reaction upon lead paper. Coal gas, it was stated, as supplied in London, was, however, always free from this impurity. This is not the case with bisulphide of carbon, which, on the contrary, is generally present. This impurity has the effect of lowering the igniting point of hydrogen. It was shown that a glass rod only very moderately heated inflamed such a mixture. There need be no fear, however, of this lowering of the point of ignition taking place in the presence of coal gas. The lecturer had found that a minute trace of this gas destroyed the lowering tendency; this, in fact, was shown. Coal gas in too minute quantity to exercise a visible effect on the luminosity of the flame made it require a much higher temperature than in the preceding experiment. The fourth lecture was closed with an experiment showing the bleaching properties of the product of combustion of bisulphide of carbon upon a red rose.

ROYAL SOCIETY.

March 14, 1867.

Lieut.-General SABINE, *President, in the Chair.*

THE following communications were read:—

"*On the Theory of the Maintenance of Electric Currents by Mechanical Work without the Use of Permanent Magnets,*" by J. CLERK MAXWELL, F.R.S. The author commenced his paper by saying that the machines lately brought before the Royal Society by Mr. Siemens and Professor Wheatstone consist essentially of a fixed and a movable electro-magnet, the coils of which are put in connexion by means of a commutator. The electro-magnets in the actual machines have cores of soft iron, which greatly increase the magnetic effects due to the coils; but, in order to simplify the expression of the theory as much as possible, he would begin by supposing the coils to have no cores, and, to fix our ideas, we might suppose them in the form of rings, the smaller revolving within the larger on a common diameter. The author concluded his paper, which was an elaborate mathematical one, with the following explanation:—Without the shunt, the current in the secondary coil is always in rigid connexion with that in the primary coil, except when the commutator is changing. With the shunt, the two currents are in some degree independent; and the secondary coil, whose electric inertia is small compared with that of the primary, can have its current reversed and varied without being clogged by the sluggish primary coil. On the other hand, the primary coil loses that part of the total current which passes through the shunt; but we know that an iron core, when highly magnetised, requires a great increase of current to increase its magnetism, whereas its magnetism can be maintained at a considerable value by a current much less powerful. In this way the diminution in resistance and self-induction due to the shunt may more than counterbalance the diminution of strength in the primary magnet. Also, since the self-induction of the shunt is very small, all instantaneous currents will run through it rather than through the electro-magnetic coils, and, therefore, it will receive more of the heating effect of variable currents than a comparison of the resistances alone would lead us to expect.

"*On a Magneto-electric Machine,*" by W. LADD. See page 141.

"*On Certain Points in the Theory of the Magneto-electric Machines of Wilde, Wheatstone, and Siemens,*" by C. F. VARLEY, Esq., in a letter to Professor Stokes, Sec. R. S.

Fleetwood House, Beckenham, S.E.,
February 23, 1867.

My dear Sir,—Professor Wheatstone showed that a shunt put into the circuit of the electro-magnet increased the power greatly, but the explanation that it increased the power by equalising the resistance of the armature and that of the electro-magnet is either wholly incorrect or very nearly so.

Yesterday I had an opportunity afforded me by Mr. C. Siemens of experimenting with his machine, in which the electro-magnets have each a resistance of about 250 Ohms = 500 Ohms, the armature 400 Ohms.

On adding a shunt to the electro-magnet, the flame was greatly increased.

The two electro-magnets when connected in series had a resistance of about 500 Ohms. I then connected them in a double circuit, the resistance in this case being about 125 Ohms. By this means the same result as regards resistance could be obtained as by a shunt, with the difference that the power expended in the shunt is lost in heat; while reducing the resistance by the double circuit caused the whole force to be expended on the electro-magnet.

The results of the experiment were—

1st. The shunt invariably increased in power.

2ndly. When the magnets were joined in double circuit, the power was greatly reduced.

The explanation is to me obvious. In a Ruhmkorff's coil, where the iron core is divided into fine wire, so that the dying magnetism cannot set up currents in the iron core to prolong its existence, the magnetism is very rapidly lost, and the make-and-break hammer works very rapidly, sometimes as fast as sixty beats per second.

If the secondary circuit be closed so that the currents can flow, the make-and-break hammer works very slowly, indeed one or two beats per second; and in 1856 I published a description of electro-magnets whose action was very slow, and which were rendered sluggish by a copper cylinder around them.

Wilde's armature, when revolving, sends intermittent currents around the electro-magnet, whose circuit is broken at every half revolution of the armature.

Were the magnets composed of fine iron wire, the magnetism would die away rapidly, producing a violent current by its efforts to maintain itself, as in the Ruhmkorff's coils. (This current is called by foreigners the extra current.)

The shunt which Wheatstone inserted carries this current across, and so maintains the magnetism of the electro-magnets until the armature gives a second impulse. The current in this shunt will be found to travel in alternate directions; not so that on the electro-magnet.

When the armature is discharging its current into the electro-magnets, the current in the shunt is in the direction it would have if the shunt were in circuit solely with the armature.

When the armature is changing poles and is disconnected, the secondary current is in full play, and the current in the shunt is in the direction of the current prolonged in the electro-magnet—that is, of the extra current.

The force expended in the shunt is wasted in heat; but a secondary wire on the electro-magnet or a copper cylinder would very greatly add to the power by maintaining the magnetism, and not consume uselessly the force now wasted in the shunt.

The overlapping of the armature and the solid mass of the electro-magnets tends to maintain imperfectly the magnetism during the intervals of no current from the armature; and but for this the machines, whether they be Wilde's, Wheatstone's, or Siemens', would none of them work.

In 1860 I published a description of two machines I had constructed, and in 1862, at the Universal Exhibition, I exhibited a machine for adding mechanical force to static electricity without friction. A machine similar in principle, but a little different in construction, has been exhibited recently under the name of Holtz.

One of my machines bears to the other precisely the same relation that Siemens' or Wheatstone's does to Wilde's.

If these be of sufficient interest to the Royal Society, I shall be happy to exhibit them. I am, &c.

C. F. Varley.

SOCIETY OF ARTS.

On the Synthesis and Production of Organic Substances and the Application which some of them receive in Manufactures, by Dr. F. Crace Calvert, *F.R.S., F.C.S., &c.*

Lecture II.

(*Continued from page* 110.)

Having thus studied the series of molecular and chemical actions, by which starch is transformed into sugar, dextrine, glucose, alcohol, acetic acid, mannite, lactic acid, and butyric acid, let us still pursue the interesting transformations of sugar into one or two more products. Thus, if starch or sugar is mixed with peroxide of manganese and sulphuric acid, and heat is applied, a most violent chemical reaction ensues, and the most important product thus generated through the oxidation of the sugar or starch by the oxygen of the oxide of manganese, liberated by its contact with sulphuric acid, is an acid referred to in my last lecture, namely formic acid, a substance found to characterise ants, the artificial production of which acid I described to you by methods which have been devised by M. Berthelot. Again, if we take starch or sugar, and act upon it with nitric acid or aquafortis, we shall convert it into a white crystalline substance, oxalic acid, which for many years was entirely extracted from a wild plant called *Oxalis acetosella*, which in fact was the only known source of obtaining a substance so extensively used by the cleaners of straw-bonnets, and in calico-print works, as well as by the careful housekeeper to remove iron-moulds from linen. At the present day, through the progress of chemistry, a pound of oxalic acid is not dearer than an ounce was formerly, for not only is oxalic acid obtained by the action of nitric acid on sugar, but it is also produced in large quantities at Warrington, in Lancashire, by Messrs. Roberts, Dale, and Co., through the action of a mixture of caustic soda and potash on sawdust, where, under the oxidising influence of the alkali incited by heat, the lignin, or fibre of the wood, which has an isomeric composition with that of starch, is oxidised and converted into oxalic acid. It would carry me far beyond the limits of a lecture were I to examine in detail how those substances in their turn can be converted into others, or the numerous classes of substances to which they give rise. I must, therefore, content myself with examining with you generally the subject under consideration, leaving details for the student. It will be easy to conceive what an amount of useful information the student will derive from such a pursuit; and you will see this more clearly if I lift up a corner of the veil, and give you an insight into those treasures of information. Let me, therefore, refer to some of the transformations of alcohol, a substance so well known to all of us by its presence in most of the beverages we take, and also from its extensive employment in arts and manufactures.

The conversion of alcohol into ether presents one of the most interesting and remarkable instances known in chemistry of the unfolding of a substance into two others, under the influence of certain molecular forces known to chemists (but yet badly explained) as actions of contact, or catalytic actions—that is to say, that science has observed several instances where a substance, when placed in the presence of another, under stated circumstances, will undergo special chemical decompositions, quite different from those which it will experience if the other substance is absent. The unfolding of alcohol into ether and water is a remarkable example of this class of molecular actions. Thus, if 70 parts of strong alcohol are carefully mixed with 100 parts of concentrated sulphuric acid or vitriol, and the whole allowed to remain for a few hours in contact, and are placed in a retort, to which heat is applied, so as to raise the temperature to 284°, it will be observed that one molecule of alcohol will split itself into one molecule of ether and one molecule of water. If such a transformation was to stop there, interesting as it is, it would be only similar to many others which I have brought before your notice. But such is not the case; for if in the heated fluid a small continuous stream of strong alcohol is introduced, it will be found that as the alcohol reaches the heated mass it will unfold itself into water and ether, which distil and still keep separate in the condensed part of the apparatus or receiver. Therefore, under the influence of a compound called sulphovinic acid, and heated at 284°, the alcohol which is introduced in such a mass is unfolded, as just stated, into two compounds which cannot unite, though they were united before they came in contact with the sulphovinic acid, or had experienced the catalytic action of the sulphovinic acid or sulphuric acid.

I hope you do not forget that in my last lecture I called your attention to another action of sulphuric acid on alcohol, viz., that if three parts of sulphuric acid were mixed with one of alcohol, and heat applied, the sulphuric acid, instead of separating one equivalent of water from the alcohol, so as to transform it into water and ether, would in that case remove two molecules of water, retain them, and liberate a gas which we called olefiant or ethylene. If, instead of acting upon alcohol with sulphuric acid, we act upon it with nitric acid or aquafortis, we produce nitric ether, or what is commonly called spirit of nitre; and if we mix alcohol with acetic acid, or, what is still better, with a mixture of acetate of soda and sulphuric acid, we obtain a most agreeable perfumed substance called acetic ether, which contributes largely to the flavour of wines and spirituous liquors. In fact, a great variety of compound ethers can be produced by bringing alcohol in contact with an acid, and applying heat; or, what is still more effectual, by bringing into play the action of still more powerful acids, such as sulphuric or hydrochloric, which by their presence help the transformation of alcohol into those compound

ethers so much used in medicine as therapeutic agents. Again, if to a mixture of alcohol and sulphuric acid a small quantity of manganese be added, and a gentle heat applied, a new substance is produced, differing entirely in its properties from that which results from the action of sulphuric acid and peroxide of manganese on sugar, for in that case formic acid is produced, whilst, in the one now under consideration, the substance called aldehyde is generated, which substance is characterised by the remarkable property it has of reducing the salts of silver, instances of which you have no doubt often remarked in the metallic globes in shop windows, which present a brilliant reflecting surface, due to a silver deposit, resulting, generally speaking, from the reduction of a salt of silver, by means of aldehyde. Lastly, this substance, which was two or three years ago a laboratory product, is now manufactured in large quantities, being used extensively for reducing, in conjunction with hyposulphite of soda, the splendid red tar colour known under the name of magenta, into that brilliant green which most of you have admired, under the name of *vert lumière*, from the fact that it maintains not only its green colour by artificial light, but that under the influence of that light its intensity is greatly increased.

NOTICES OF BOOKS.

Essai sur les Institutions Scientifiques de la Grande-Bretagne et de l'Irlande. Par Ed. Mailly, docteur en sciences, chevalier de l'ordre de Léopold, &c. Bruxelles: Hayez. 1867.

This work contains a succinct account of the scientific societies, the observatories, and the universities of the United Kingdom, with an outline of the Nautical Almanac and the British Museum. It professes to be composed from official sources, and, as far as it is possible to judge from a hasty survey, it is remarkably accurate. It would be difficult to find in our own language so brief and so clear a description, at the same time free from party bias. A few errors in proper names—for instance, "Sir Murchison"—mark the difficulty foreigners have in understanding our titles, but serve to set off the extreme accuracy of the descriptions of subjects so unintelligible even to many natives at our universities. If the book meets with the success it deserves, it will contribute greatly to that better understanding of English institutions and English character which is beginning to mark the foreign writers who attempt that hitherto incomprehensible subject.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Bulletin de l'Académie des Sciences de Belgique. No. 12. December, 1866.

C. Glaser: "*Researches on some Derivatives of Cinnamic Acid*," First Part.

Monatsbericht der königlich-Preussischen Akademie. September-October, 1866.

Hincks "*On a Newly Discovered Record of Ancient Lunar Eclipses.*"

Kunst und Gewerbeblatt. November-December, 1866.

R. Wagner: "*Contributions to the Knowledge and to the Quantitative Estimation of the Tannic Acids.*"—C. F. Bazin, A.M., and C. F. Daude: "*A Method of Drying Gold-beaters' Skin in a Vacuum.*"—J. von Schwarz "*On the Manufacture of Refractory Articles from Clay Slate.*"—F. Jünnemann "*On the Transformation of Tallow into Adipocire.*"—"*On the Rusting of Weights.*"

Zeitschrift für Bauwesen. 1867. Nos. 1 and 2.

A. Cremer "*On the New Laboratory at Berlin.*"—Heidmann "*On Morin's Studies on Ventilation,*" continuation.—A. Meydenbauer "*On the Application of Photography to Architectural Plan Drawing and Surveying.*"—Boeckmann: "*Notes of a Visit to London, including Remarks on the Arrangement of Houses, Waterclosets, Lighting, Warming, Ventilating, Water Supply, Hotels, Kamptulicon, Covering for Roofs, Metropolitan Railway and Railway Stations;*" "*Notes of a Visit to London, including Remarks on the Street Traffic, Thames Embankment, Public Buildings, Crystal Palace, and the Royal Institute of British Architects,*" conclusion; "*On the Best Kind of Mortar for Use in Running Water.*"—Assmann "*On the Mint at Berlin.*"—Röder "*On obtaining Gold from the Old Silver Coinage of Prussia.*"—Louse "*On the Means of Preventing the Efflorescence of Saltpetre from Brickwork.*"—"*On the Water Taps of the New Laboratory of Greifswald.*"—Knoblauch "*On a New Gas Regulator.*"

Comptes Rendus. February 4.

Becquerel "*On an Electric Psychrometer and its Applications.*"—A. Mallet: "*A Method of preparing Oxygen.*"—L. Hermann: "*Note on the Danger of using Protoxide of Nitrogen as an Anæsthetic.*"—Bontemps: "*Remarks on a Memoir on Glass recently presented by J. Pelouze.*"—A. Béchamp "*On the Formation of Alcohol by the Living Organism which Produces the Pebrine.*"

February 11.—H. Deville and L. Troost "*On the Coefficient of Expansion, and on the Density of Hyponitric Acid Gas.*"—E. Fremy "*On the Isomeric Forms of Silicic Acid, and on Polyatomic Acids,*" First Memoir.—E. Frankland and B. F. Duppa: "*Synthetical Researches on Ethers.*"—A. Piche: "*Some new Remarks on the Invention of the Continuous Rotating Electrophorus.*"—Delenda "*On the present State of the Volcanic Phenomena at Santorin;*" "*On the Ancient Monuments discovered at Therasia.*"—C. M. Guillemin "*On the Discharge of the Battery and on the Influence of the Shape of the Conductors.*"—Colombi "*On a Method of Choosing Spectacles.*"—Van der Mensbrugghe "*On the Tension of Liquid Films.*"—C. Mene "*On the Quantity of Iron contained in some Ores from the Coal Districts of Central France, together with an Analysis of these Ores.*"—Reboul "*On some New Derivatives of Valerylene.*"—C. Saintpierre and A. Pujo; "*Researches on the Density of the Wines of the Department of the Hérault,* apropos *of the Question of Selling Wine by Weight instead of by Measure.*"—Felici: "*Description of a Lecture Experiment for rendering visible the Curve formed by a Vibrating Cord.*"

Revue Universelle des Mines. September-October, 1866.

A. Habets: "*Notes on the Mechanical Preparation of Ores: On P. Rittinger's and on Hundt's Continuous Apparatus.*"—"*On Blasting by Electricity.*"—"*On the Use of Nitroglycerine.*"—"*On Continuous Shaking Tables for Dressing Ores.*"—Gentele "*On the Treatment of Galena containing Zinc.*"—Dahne: "*A new Furnace for Extracting Zinc.*"—C. Zerrenner "*On the Deposits of Emery at Kornilowsk.*"—A. Von Groddek: "*Reply to M. Cornu's Note on the Numerical Relations which exist between the Chemical Equivalents of certain Minerals which occur in Veins.*"—Neimcke "*On the Use of Nitroglycerine in the Hartz;*" "*An Improved Blasting Powder.*"—Schuchardt "*On the Poisonous Properties of Nitroglycerine.*"—F. Abegg "*On the Application of Electricity to Blasting Purposes.*"—Schneider "*On Rittinger's Improved Shaking Table for Dressing Ores.*"—Rittinger "*On Hundt's Rotary Buddle.*"—Kleinschmidt "*On the Extraction of Copper, Silver, and Mercury at Stephanshütte, Hungary.*"—H. Honsell "*On the Extraction of Lead at Zsarnowitz, near*

Schemnitz."—Albert "*On the Extraction of Salt at Schönbeck.*"—Heberle "*On the Transmission of Motion by Wire Ropes and Hydraulic Pressure.*"—H. Tresca and C. Laboulaye: "*Researches on the Mechanical Theory of Heat.*"—A. Laussedat "*On the Theory and Use of Professor Robert Willis's Odontograph.*"—A. Payen: "*Note on Iodide of Potassium, and on the Acetates and Oxides of Lead;*" "*On Diastase and Woody Tissue.*"

NOTICES OF PATENTS.

1823. *Manufacture of Iron and Cast-iron.* J. N. Fournel, Nancy, France. Dated July 11, 186.

In this invention the fuel is heated separately, and the carbonic oxide produced is led by pipes to the furnace in which the ore is to be heated, where it is mixed with compressed air, and a flame is produced similar to that of the laboratory blowpipe, by means of which the deoxidation of the ore is effected.

1827. *Producing Illuminating Gas.* W. G. Walker and R. F. Smith, Kilmarnock. Dated July 12, 1866.

An invention for producing gas from peat by saturating it with shale oil or petroleum or other mineral hydrocarbon, and applying heat in the usual manner.

1846. *Preserving Timber from Decay.* A. Prince, Trafalgar Square, London. A communication. Dated July 13, 1866.

The patentee claims the application of crude petroleum, with or without mineral paints or pigments, for preserving timber from decay.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

47. W. Way, M.D., Eliot Place, Blackheath, Kent, "Improvements in preparing phosphatic minerals for use as manure." Partly a communication from C. Henwood, Sombrero, West Indies.—Petition recorded Jan. 7, 1867.

358. W. S. Losh, Wreay Syke, Cumberland, "A method of manufacturing a salt or salts of ammonia."—February 8, 1867.

378. E. Gorges, Neuilly, France, "Improvements in preserving meat, poultry, and game."—February 9, 1867.

492. W. Clark, Chancery Lane, "Improvements in the manufacture and ornamentation of anhydrous, rectified, and double-faced toilet soaps." A communication from P. B. Mongeot, M.D., Boulevart St. Martin, Paris.

494. C. Kessler, Frankfort-on-Maine, "Improvements in the manufacture of carbonate of soda and of potash."—February 22, 1867.

505. P. A. Muntz, Keresley, near Coventry, Warwickshire, "Improvements in the manufacture of certain metallic alloys."—February 23, 1867.

512. E. Chapron, Luxembourg, "Improvements in the treatment of peat."—February 25, 1867.

564. M. Woolrich, Well House, Handley, Cheshire, "Improvements in means and apparatus employed for the cure of the disease called 'foot-rot' in sheep."

568. W. Clark, Chancery Lane, "Improvements in the means and apparatus for producing oxygen, and in the application of the same for metallurgical and other purposes." A communication from H. A. Archereau, Boulevart St. Martin, Paris.—February 28, 1867.

Inventions protected for Six Months by the Deposit of Complete Specifications.

651. W. H. Towers, New York, U. S. A., "A new and useful process whereby leather, wholly or partially tanned, or animal tissue of any nature, is made hard, semi-elastic, and transparent, and rendered a fit material from which to manufacture combs, buttons, buckles, eye-glass frames, splints, knife handles, articles of jewelry, and other articles now produced from vulcanised india-rubber."—Petition recorded March 7, 1867.

684. H. A. Bonneville, Rue du Mont Thabor, Paris, "A new and improved means of preserving solutions of certain plants and matters in a concentrated state." A communication from C. d'Estains, Rue de Chaillot, Paris.—March 11, 1867.

Notices to Proceed.

2783. J. Blackman and E. Blackman, Knightsbridge, Middlesex, "Improvements in medicine for the cure of whooping and other coughs."—Petition recorded Oct. 27, 1866.

2825. J. H. Shorthouse and J. Ferguson, Birmingham, "An improved process for recovering and utilising certain waste metallic products."—October 31, 1866.

2847. J. Harris, Threadneedle Street, London, "Improvements in apparatus for the production, distillation, and refining of hydrocarbon and other oils from shale, cannel, coal, peat, lignite, or other bituminous minerals."

2850. R. J. Gay, Badshot Lee, Farnham, Surrey, "An improved composition for coating walls or other surfaces so as to render them impervious to the action of water or moisture."

2858. F. Claudet, Coleman Street, London, "Improvements in treating waste solutions obtained from burnt cupreous pyrites."—November 3, 1866.

2873. N. F. Taylor, Manby Street, Stratford, Essex, "Improvements in means for operating on air or aëriform fluids by hydrocarbons for purposes of illumination."—November 6, 1866.

CORRESPONDENCE.

Standard Thermometers.

To the Editor of the Chemical News.

Sir,—Your correspondent "G. L.," who directed me as to the way of acquiring information, deserves an answer. I have waited to see if any other gentleman would give one, but as this is not the case, I beg that you will kindly insert this. According to "G. L.," the satisfactory explanation of the phenomenon—that correctly graduated thermometers acquire afterwards an index error which may amount to 2°—is given in any good treatise on physics; but if "G. L." will consult his books again, he will find it clearly stated that no satisfactory explanation has yet been given, and this was exactly the reason why I sought the same from a careful manufacturer like Mr. Pastorelli, who, by exact observations, might have found it out in the course of his long experience.

According to "G. L.," rise of the mercurial column is owing to the boiling of the mercury in the glass, and the slow after-contraction of the same. But how does this explanation harmonise with the real facts? As "G. L." has made careful thermometric observations, he is cognisant that the boiling of the mercury in the tube causes the mercurial column, by inserting it afterwards in ice-water, to rise 2°; it is, therefore, clear that the boiling of the mercury in the tube would rather tend to correct the error instead of increasing the same. The boiling of the mercury can, therefore, not be the cause of this phenomenon. That "G. L." did not accept it as an established fact follows from the after explanation, where the same is attributed to the one-sided pressure of the air. As regards the insufficiency of this statement, I have to refer your correspondent again to books where the refutation of it is clearly given, as it is there stated that thermometers which contain air acquire the same error as those with a vacuum; and if "G. L." had consulted a practical manufacturer, he might have learned that the

one-sided pressure amounts only to about ·4° for about 15 lbs. on the square inch, and cannot, therefore, explain a difference that reaches 2°. Yet "G. L." may complain that he did not mean that the error was owing to the boiling of the mercury, but to the force which was done by it to the glass, particularly as he states (a known fact) that the indications of a thermometer became incorrect after it had been exposed to high temperatures, the difference of these errors depending upon the composition of the glass. The error that would arise from this cause is not stated, and has been probably over-estimated. I find that it does not exceed more than ·2° to ·3°, even if the mercury has been heated to nearly the boiling point, provided it has not actually boiled. (This error will depend upon the composition of the glass.) Errors which are caused in thermometers by subjecting them to higher temperatures amount only to about 10 per cent. of those of which we originally spoke. But if the one-sided atmospheric pressure amounts only to about ·4°, and the fall in consequence of heating a thermometer to nearly the boiling point to ·2° or ·3°, it follows that if they acted in the same direction even both could not jointly cause the index error. We must therefore seek the real reason elsewhere. In the course of the above statements we have come to a new thermometric phenomenon, which likewise wants explanation—viz., how is it that thermometers, heated until the mercury actually boils, acquire afterwards a rise in the freezing point of about 2°, whilst a fall occurs of about ·2° if they are heated up to nearly the boiling point?

I am, &c. A Subscriber.

P.S.—I might have added that the heating of a thermometer in boiling water causes likewise the same index error of about ·2° as that obtained by subjecting it to a much higher temperature. I may also state that I am very much indebted to Mr. Pastorelli, he having kindly given me the results of a series of carefully conducted thermometric experiments.

[If "A Subscriber" will favour us with some of the valuable information he has acquired from Mr. Pastorelli in explanation of the above phenomena, it will doubtless be highly appreciated.—Ed. C. N.]

Science Teachers.

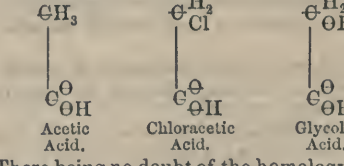
To the Editor of the Chemical News.

Sir,—I have only just seen the letter of a "Science Teacher" in the Chemical News of the 8th inst., or I should have noticed it earlier. Like him, I think that "my Lords" have made a wrong move in abolishing the special examinations for science teachers, if they only meant to replace them, as they have done, by the first and second class grade certificates of the May examinations. If "my Lords" consider that a certificate of a teacher's competency is necessary other than the success of the pupils he sends in for examination, it seems to me that to lower the standard of qualification as they have done is simply to render it almost, if not entirely, abortive. If an examination is necessary at all, let it be a good one; but I contend that the principle of restricting payment "for results" to teachers who possess the departmental certificate is a thoroughly unsound one, and quite opposed to those principles of free trade which are now universally recognised in all other matters. Why should A., who sends in three successful pupils to the May examination, and who possesses a certificate, be paid for their success, while B., who may send in six, receives no payment, simply because he has no certificate? What is the simplest and best test of the efficiency of teaching but the "results" themselves which come of it? A man may be able to pass a very fair examination, especially such an examination as certificated teachers have been hitherto called upon to pass, and yet make but a very poor teacher after all; whilst there are many men most competent to teach who, for one reason or another, may be unable or unwilling to subject themselves to the departmental examinations. For my own part I believe that the only just and sound principle is to leave the teachers to show their efficiency by the number of successful pupils which they can send in for examination, and to pay them accordingly. The new regulation certainly has the combined disadvantage of maintaining the old protectionist policy, whilst it at the same time abolishes the reason for doing so. I am, &c.

A Non-Certificated Teacher
(so far as the Department of Science and Art is concerned).

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Bibasic Acids (C = 12, O = 16).—A. Claus. According to the theory of types, oxalic and succinic acids belong to the same homologous series, whilst Kolbe derives oxalic acid from the diatomic radicle ($\overset{II}{C_2}O_2$) and succinic acid from the tetratomic radicle ($\overset{IV}{C_2}O_2$). Claus thought that the application to succinic acid of some of the methods of reduction which have been studied in connexion with oxalic acid would help to decide whether or no these two acids are homologous. He fruitlessly repeated experiments which some of Church's published researches led him to believe would be successful, and finding that neither zinc and succinic acid nor sodium amalgam and succinic acid gave anything but zinc and sodium salts of succinic acid, he entered the path opened by Frankland and Duppa, who have proved that one atom of oxygen in oxalic acid is replaceable by two atoms of an alcohol radicle. Succinic acid behaves under like conditions in a totally different manner from oxalic acid—indeed, ethyl will not replace oxygen in it. The results of his experiments with sebacic acid were perfectly analogous to those obtained with succinic acid. It would seem, then, that oxalic and succinic acids do not belong to the same series, and in further support of this view may be cited the impossibility of making the oxalic anhydride or chloride; nor can it be objected to this argument that the radicle of oxalic acid contains no hydrogen, for if the presence or absence of hydrogen in the radicle causes so great difference in the chemical behaviour of two compounds they cannot be correctly described as homologous. The error will probably be but small if we consider oxalic acid as a derivative of acetic acid, so far resembling glycolic and chloracetic acids, as may be seen on comparison of their formulæ:—



Acetic Acid. Chloracetic Acid. Glycolic Acid. Oxalic Acid.

There being no doubt of the homology of acetic and butyric acids, it follows that if oxalic and succinic acids are homologous, the latter acid should bear to butyric acid similar relations to those which have just been shown to exist between oxalic and acetic acids. A close examination, however, of the constitution of butyric acid shows that the acid resulting from its oxidation, though isomeric with, is yet different from, succinic acid; also the oxidation of butyric acid failed in Claus's hands to give succinic acid under the conditions described by Dessaignes. There are also strong theoretical reasons for doubting the identity with succinic acid of the acid obtained from cyanopropionic acid by Kolbe's and H. Müller's reactions. The chemical structure of succinic acid is best expressed by Kolbe's formula, modified, however, in accordance with the results

obtained by Simpson, who, in the synthesis of succinic acid from ethylenic cyanide, proves the existence in that acid of ethylidene, whilst Kolbe and Kekulé hold it to be ethylene.—(*Annal. Chem. Pharm.* cxli. 49.)

Ammonias, a New Class of Compound (C = 12, O = 16).—A. Wurtz. Pseudo-amylurea, under the influence of potash, splits into carbonic anhydride, ammonia, and iso-amylamine; this body, after distillation from caustic baryta, boils at 78·5° corr. (amylamine boils at 95°), and has sp. gr. 0·755 at 0° (amylamine 0·815); its aqueous solution precipitates metallic oxides and redissolves hydrated cupric oxide; if shaken with bromine, $C_5H_{12}BrN$ is formed; the chloride, platino- and aurochlorides were prepared, and are crystallisable. As in the pseudo-alcohol, so also in this base the individuality of the amylene molecule is preserved, as indicated by the formulæ—

$\underbrace{C_5H_{10},H(OH)}$ $\underbrace{C_5H_{10},H(NH_2)}$ $\underbrace{C_5H_{11}(OH)}$ $\underbrace{C_5H_{11}(NH_2)}$

Amylenic hydrate. Iso-amylamine. Amylalcohol. Amylamine.

(*Comptes R.* lxiii. 1121).

Furfuric Alcohol (C = 6, O = 8).—C. Stalmann. By the action of sodium amalgam on furfuric acid a viscid liquid is obtained of the composition represented by

$$\left.\begin{matrix}(C_8H_3O_2)\\H_2\end{matrix}\right\}C_2O,HO,$$

which appears to be identical with the alcohol obtained by Schmelz and Beilstein from furfurol.—(*Zeitsch. Chem.*, N.F., iii. 47.)

Glycolamidic Acids, the Constitution of.—H. Kolbe. Monoglycolamidic acid is constituted similarly to monochloracetic acid, from which it is derived by the replacement of the chlorine atom by amidogen, glycolic acid being acetic acid, in the methyl radicle of which H_1 is replaced by one molecule of hydroxyl (HO_2), as shown by the formulæ—

$\underbrace{(C_2H_3)[C_2O_2]O,HO.}$ $\underbrace{C_2\left\{\begin{matrix}H_2\\Cl\end{matrix}\right\}[C_2O_2]O,HO.}$

Acetic acid. Monochloracetic acid.

$\underbrace{C_2\left\{\begin{matrix}H_2\\HO_2\end{matrix}\right\}[C_2O_2]O,HO.}$ $\underbrace{C_2\left\{\begin{matrix}H_2\\H_2N\end{matrix}\right\}[C_2O_2]O,HO.}$

Glycolic acid. Monoglycolamidic acid.

Diglycolic acid results from the union of a molecule of glycolic acid with one of monochloracetic acid, with elimination of chlorhydric acid; it is no other than malonic acid in the methylene radicle, of which H_1 is replaced by one molecule of methoxyl; diglycolic acid being then in all probability oxymethylmalonic acid, diglycolamidic acid becomes methylamidomalonic acid, and its derivation from monoglycolamidic and monochloracetic acids is exactly analogous to the derivation of diglycolic acid just described. If this view be correct, the careful heating of diglycolamidic acid with soda-lime should give methylamidacetic acid (sarkosine) or a product of its decomposition. Similarly, triglycolamidic acid would spring from the union of diglycolamidic and monochloracetic acids, chlorhydric acid being eliminated; it is a tricarbic acid (tricarbonsäure), the trivalent radicle of which is a derivative of formyl, H_1 being replaced by dimethylamide.—(*Zeitsch. Chem.*, N.F., iii. 47.)

Synthesis of Oxalic Acid (C = 6, O = 8).—Berthelot has oxidised various hydrocarbons by means of potassic permanganate with the following results:—Acetylene gives oxalic and formic acids and carbonic anhydride. Ethylene gives the same. Allylene (homologous with acetylene) gives malonic and acetic acids and carbonic anhydride. Propylene gives malonic, oxalic, acetic, and formic acids and carbonic anhydride. Amylene gives the volatile and many of the fixed acids. Among the latter are probably pyrotartaric (the normal product), succinic, and malonic acids. Styrolene gives benzoic acid and carbonic anhydride, but phtalic acid could not be produced. He considers that the dibasic acids are the primary products, the monobasic acids being secondary effects. Thus allylene gives malonic acid as a normal product—

$$C_6H_4 + O_8 = C_6H_4O_8;$$

nascent malonic acid splits thus—

$$C_6H_4O_8 = C_4H_4O_4 + C_2O_4;$$

nascent acetic acid so formed is oxidised—

$$C_4H_4O_4 + O_6 = C_4H_2O_8 + H_2O_2;$$

and oxalic acid finally gives

$$C_4H_2O_8 = C_2H_2O_4 + C_2O_4. \quad (Comptes\ R.\ lxiv.\ 35.)$$

Nitrogen, Determination of.—Ch. Mène, by a modification of the ordinary method of analysis, is able to operate on 10—15 grammes of substance in each determination, and not only in commercial analyses, but also when working with pure substances. He employs earthenware retorts, such as are used for making oxygen from manganic binoxide, fills them with stick potash, and puts in the substance to be analysed in the form of little balls moistened with strong caustic soda solution, adapts a glass tube to the beak of the retort, heats the retort even to a cherry-red heat, and collects the ammonia disengaged in a chlorhydric acid solution. The ammonia, being generally accompanied by empyreumatic bodies, the colour of which prevents the use of a standard alkaline solution, must be weighed as chloroplatinate.—(*Comptes R.* lxiv. 42.)

Physostigmine (C = 6, O = 8).—O. Hesse has resumed the examination of the poisonous principle contained in the Calabar bean. The freshly prepared alcoholic extract of the bean is shaken with sodic bicarbonate and ether. Very dilute sulphuric acid takes the physostigmine from the ether, and in its turn gives it up when treated with sodic bicarbonate and ether; the ether, on evaporation, leaves the pure alkaloid. It is tasteless, uncrystallisable, capable of enduring for a short time a temperature of 100°, but presently decomposing, easily soluble in alcohol, ether, benzol, chloroform, and carbonic bisulphide, difficultly so in water. Its solution is strongly alkaline, and perfectly neutralises acids. Solutions of its sulphate, chloride, or acetate are tasteless and colourless, become pink on exposure to air, and are decolorised by reducing agents or animal charcoal. The coloration, which is intense when the solutions are made alkaline and heated, results from oxidation. Its formula is $C_{30}H_{21}N_3O_4$. A solution of iodine in potassic iodide produces with it a crimson precipitate; it is also precipitated by HgI, KI, HgCl, $AuCl_3$, and tannic acid, but not by platinic chloride.—(*Annal. Chem. Pharm.* cxli. 82.)

MISCELLANEOUS.

Elimination and Estimation of Nitric Acid contained in Well Water.—Having satisfied one's self of the existence of nitrates by preliminary experiments with the pyrogallic acid test given by me in No. 183 of the Chemical News, p. 257, evaporate half a gallon of the water down to about 6 or 8 ounces, and filter. Boil the filtrate with excess of sulphate of silver so as to abstract the chlorine, filter and precipitate the excess of silver by liquor potassæ, neutralise the filtrate with *q.s.* of dilute sulphuric acid, and evaporate it to dryness, so as to obtain nitrate and sulphate of potash; mix this residue intimately in a mortar with two or three times its bulk of powdered pipeclay or kaolin, place it in a small stoppered porcelain retort connected with a receiver containing distilled water and crystals of hydrate of baryta or strontia. On the application of a strong red heat to the retort, the whole of the nitrous acid will be driven over into the receiver. Absorption having taken place, filter the liquid, and evaporate carefully to dryness, redissolve the residue in distilled water, filter and again evaporate to dryness. Lastly, dissolve out the nitrate of baryta with distilled water, filter and estimate the amount of nitric acid by

titration with a standard solution of sulphate of ammonia (6 grains per drachm), taking into account the difference in the equivalents of sulphuric and nitric acid, every 60 minims representing 4·32 grains of nitric acid.—*John Horsley, F.C.S.*

London Well Water.—Dr. Letheby has lately again (for the fourth time) drawn the attention of the Sanitary Committee of the Commissioners of Sewers of the City of London to the dangers attending the use of the water of the City pumps. He shows conclusively—as Mr. Simon did seventeen years ago—that the coolness of such water is derived from substances, such as nitrate of potash and common salt, which are formed as the results of animal decompositions from churchyards and infiltrated soil. Surely, he argues—as was argued seventeen years ago—if you get these ultimate products, you must obtain with them some of the mediate ones; the latter specially dangerous in times of epidemics. The arguments of 1850 are repeated, and the latest analyses of these waters are very similar to those made then; but the more melancholy fact is, that the evils attendant upon their former use are more than ever demonstrated by the last epidemic. Such a demonstration was not needed, and while thanking the authorities for the light that they have thrown upon the spread of epidemics by surface water, we would suggest that the evidence is complete, and that no further experiments are at all necessary. At all events, we can assure them that another lapse of seventeen years, and scientific reports and analyses yearly upon the state of the London surface water for the further consideration of the matter, are simply so much time, trouble, and money thrown away.

On the Separation of Strychnine Salts by Carbolic Acid.—When a weak solution of hydrochlorate of strychnine is shaken with some drops of carbolic acid, the liquid assumes the appearance of an emulsion. It has then little activity when administered by the hypodermic method, but this relative innocuousness is due to a simple sluggishness of absorption, and not to a destruction of the strychnine by carbolic acid, for on removing this with ether, a limpid solution is obtained as energetic as at first. If the emulsion is carefully filtered and the filtrate treated with ether, it has no longer any toxic property; on the contrary, that which remains on the filter, being diffused in water and freed by means of ether from the carbolic acid which it contains, forms again the strychnine salt at first taken. Carbolic acid has the effect, therefore, of holding in suspension the strychnine salt, and singularly facilitating its separation. The author has found that strychnine can be easily separated in this way from putrescent animal matter. —*M. Paul Bert*, in the *Gazette Médicale.*

To distinguish Arseniuretted Hydrogen from Antimoniuretted Hydrogen.—On passing a mixture of these two gases through a tube containing solid pieces of caustic potash, these become covered with a brilliant metallic coating of antimony, whilst the arseniuretted compound escapes undecomposed. A ley of potash, density 1250, only acts very slightly in a similar case. The fragments of potash which have become metallised by the deposit of antimony are altered in the air; they soon become white in water, the metallic coating falling to the bottom; but when they are attempted to be collected on a filter they dissolve before the liquid has even passed through. In the clear filtrate, antimony is found in solution, and the author fancies that it exists in the form of antimoniate.—*M. Dragendorff*, in *Zeitschr. analyt. Chem.* 1866, p. 201.

Employment of Hypochlorite of Magnesia in Bleaching.—The following has been discovered in an examination of the action of hypochlorite of magnesia, and the preference which is given for it when delicate tissues have to be bleached:—1. This hypochlorite decomposes more easily than the lime compound; 2. The liberated magnesia is without action on the tissue. This cannot be said of lime. The best way of preparing hypochlorite of magnesia consists in decomposing sulphate of magnesia with hypochlorite of lime. When the sulphate of magnesia contains manganese, the liquid assumes a red colour, and loses its bleaching power.—*MM. Bolley and Jokisch*, in *Schweiz. Polyt. Zeitschr.* 1866, p. 120.

Meetings for the Week.

Tuesday, March 26.

Royal Institution, 3 p.m. Rev. G. Henslow "*On Botany.*"

Royal Medical and Chirurgical Society, 8½ p.m.

Wednesday, March 27.

Society of Arts, 8 p.m.

Thursday, March 28.

Royal Institution, 3 p.m. W. Pengelly, Esq., "*On the Antiquity of Man.*"

Royal Society, 8½ p.m.

Friday, March 29.

Royal Institution, 8 p.m. Professor Frankland "*On the Water Supply of the Metropolis.*"

Saturday, March 30.

Royal Institution, 3 p.m. W. Pengelly, Esq., "*On the Antiquity of Man.*"

Chemical Society, 8 p.m. Anniversary.

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

L. O. Q.—A patent for the introduction of sulphur into soap was taken out in 1862, but was not proceeded with.

J. Johnstone.—Marble may be rendered black and capable of taking a high polish by immersion in boiling pitch. Many other stones and minerals may be blackened, uniformly, superficially, or in fissures, by the same means.

A.—Taylor and Francis, Red Lion Court.

Student.—Send the amount to our publisher, and the book will be sent by post.

M. M. N. N.—Fractional distillation is a most imperfect and unsatisfactory way of separating members of the same series. It is only resorted to when other means fail, or as a preparatory stage to the final adoption of a chemical process of purification.

M. R. S.—By naphthalising the gas you may be able to increase its illuminating power sufficiently to take a faint photograph by it, but the results, at best, are very unsatisfactory. Why not use magnesium wire?

Vitriol.—Gay-Lussac's process for absorbing the nitrous acid, which escapes from the vitriol chambers in a tower containing coke saturated with oil of vitriol, is the one most commonly used.

John C.—The best inorganic green pigment is a preparation of oxide of chromium. A sample was exhibited in 1862 under the name of Veronese green; it was a magnificently brilliant blue green, unaffected by air, sulphuretted hydrogen, light, or time. The exact method of preparing it is not known.

Inquirer asks where he can find information on the products obtained by passing coal gas through sulphuric acid, and on the action of nitric acid upon those products. He has looked at the article on coal gas in Watts's "Dictionary of Chemistry," but cannot find that the action is alluded to, except that of dilute sulphuric acid and sawdust, as in the Rev. Mr. Bowditch's test.

Enduit Ruolz.—A correspondent wishes for information respecting the cement spoken of in the following extract from "A Canoe Voyage," by P. G. Hamilton, in the February number of the *Fortnightly Review*, p. 179:—"The most suitable material, because the easiest to manage, seemed to be paper, but the difficulty was to find a glue which would paste the paper together and yet resist water. This seemed at last to offer itself in a kind of mastic invented by the celebrated chemist Ruolz, and known as the *enduit Ruolz*. A light skeleton of laths was made for me by an ordinary joiner, and I covered this with several thicknesses of stout waterproof paper, taking care to give plenty of *enduit* between the layers. The canoe so built had a paper deck, and when finished looked exceedingly neat, presenting the appearance of an iron vessel. As to strength, the best proof of it is that, although the canoe has met with a thousand obstacles, no rock or snag has ever penetrated its paper covering; whilst the deck, though I always walked upon it to get in and out, is just as fresh as the day she was launched. It happened, however, that I put my boat to hard work at least six months too soon. The *enduit Ruolz*, though in time it becomes as hard as marble, and will even take a polish and look like polished black marble, hardens very slowly indeed when shut up between layers of waterproof paper."

Books Received.—"Familiar Lectures on Scientific Subjects," by Sir John Herschel, Bart., K.H., M.A., &c.; "An Essay on Dew," by W. C. Wells, edited by L. P. Casella, F.R.A.S.; "Chemistry, Inorganic and Organic," by Charles L. Bloxam; "The Sewage of Towns," edited by John Hitchman, M.R.C.S.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Metropolitan Water Supply during the Year 1866, *by* E. Frankland, *F.R.S.**

The following tables contain a summary of the results of my analyses of the metropolitan waters, executed for the Registrar-General, during the year 1866.

Table A. records the amount of solid impurity left on evaporation and desiccation at 120°—130° C. (248°—266° F.) of 100,000 parts by weight of water. Table B. the loss which this solid matter suffered on incineration. Table C. the amount of oxygen required to oxidise the organic matter contained in 100,000 parts of the water; and Table D. the degrees of hardness or parts of carbonate of lime (or its equivalent of other hardening salts) contained in the same weight of water. Thus, in January, 1866, we find, on referring to Table A., that 100,000 lbs. of the water delivered to consumers by the Chelsea Company contained 30·12 lbs. of solid impurity, of which, as shown by Table B., 1·44 lb. was driven off by incineration. From Table C. we learn that ·1184 lb. of oxygen was required to oxidise the organic matter in 100,000 lbs. of the said Chelsea water; whilst from Table D. we find that 21·4 lbs. out of the 30·12 lbs. of total solid impurity consisted of carbonate of lime or other soap-destroying material, which communicates to all the water delivered in London its excessive hardness.

Table E. exhibits a comparison between the years 1865 and 1866 as regards the composition and properties of the waters supplied to the metropolis. From this table it will be seen that, with two exceptions—the New River and South Essex—all the waters were harder and contained more solid impurity in 1866 than in 1865. The water delivered by the New River Company was softer and contained less solid impurity, whilst the South Essex Company's water contained less solid impurity, but was harder, in 1866 than in 1865. With one exception, the organic and other volatile matter was in every case markedly less in 1866 than in 1865. The exception is the water of the New River Company, which exhibits a very slight excess of this matter in 1866 as compared with the previous year. The amount of oxygen required to oxidise the organic matter contained in the waters was also less in 1866 than in 1865, with two exceptions—viz., in the New River and South Essex Company's waters. It must be remarked, however, that in this respect the Kent, South Essex, and New River Company's waters are greatly superior to those of all the other companies in both years.

Table A.—Solid Matter in 100,000 *Parts of the Waters.*

Names of Companies.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Thames :—													
Chelsea	30·12	31·14	28·55	28·64	26·78	25·25	25·40	24·89	24·63	27·54	30·46	31·72	27·92
West Middlesex	30·02	30·40	28·50	27·69	26·85	24·82	24·72	23·62	24·15	26·38	30·01	29·90	27·42
Southwark	29·90	30·90	29·20	29·49	27·32	24·74	25·25	23·66	24·09	28·18	30·71	31·18	27·88
Grand Junction	30·70	31·40	29·60	29·38	27·06	24·82	25·14	25·00	25·21	28·97	30·74	30·74	28·23
Lambeth	27·10	31·16	27·98	28·62	27·13	26·63	25·25	25·51	25·00	28·58	30·84	30·13	27·82
Other Sources :—													
Kent	37·70	37·92	39·80	39·02	39·98	39·28	40·42	38·88	38·60	39·28	39·59	37·99	39·03
New River	29·92	29·50	29·85	27·28	25·39	21·55	20·58	20·20	20·37	26·50	29·09	17·92	24·85
East London	35·15	32·78	33·60	30·45	35·09	26·22	24·38	26·14	26·25	30·20	31·18	34·34	30·48
South Essex	40·59	40·60	40·40	39·66	39·68	38·52	40·94	38·04	38·46	38·94	38·11	31·32	38·77

Table B.—Organic and other Volatile Matter in 100,000 *Parts of the Waters.*

Names of Companies.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Thames :—													
Chelsea	1·44	2·59	1·25	1·02	0·74	0·85	1·57	1·29	0·66	0·70	1·32	1·08	1·21
West Middlesex	1·80	2·00	1·40	1·23	0·86	0·97	1·58	1·16	0·88	0·72	1·32	1·24	1·26
Southwark	1·85	2·40	1·40	1·59	1·55	0·93	1·55	0·98	0·63	1·30	1·03	1·10	1·36
Grand Junction	1·65	1·60	1·55	1·77	0·84	0·91	1·26	1·09	0·56	0·79	1·48	0·87	1·19
Lambeth	1·94	1·65	1·33	1·96	0·90	1·01	1·71	1·53	0·91	1·70	1·30	1·19	1·43
Other Sources :—													
Kent	1·26	1·80	1·40	0·88	1·08	1·50	1·58	1·80	0·64	1·40	1·63	1·11	1·34
New River	1·30	1·68	1·92	1·79	0·53	0·91	0·58	0·89	0·78	0·71	0·71	0·88	1·05
East London	2·24	1·68	1·20	2·26	0·63	1·26	1·94	1·44	0·55	1·25	0·98	1·63	1·42
South Essex	1·69	1·36	2·10	1·40	1·98	1·66	1·96	1·80	1·21	0·98	1·00	1·48	1·55

Table C.—Amount of Oxygen required to Oxidise Organic Matter in 100,000 *Parts of the Waters.*

Names of Companies.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Thames :—													
Chelsea	·1184	·0912	·0564	·0608	·0372	·0360	·0504	·0344	·0340	·0834	·0589	·0543	·0596
West Middlesex	·0336	·0739	·0684	·0404	·0344	·0360	·0516	·0304	·0373	·0730	·0748	·0599	·0511
Southwark	·0568	·0643	·0496	·0628	·0600	·0420	·0596	·0336	·0315	·0670	·0866	·0629	·0564
Grand Junction	·0627	·0555	·0484	·0620	·0404	·0368	·0548	·0368	·0323	·0761	·0790	·0540	·0532
Lambeth	·1288	·0592	·0992	·0548	·0452	·0424	·0560	·0368	·0467	·0804	·0760	·0599	·0654
Other Sources :—													
Kent	·0096	·0104	·0092	·0070	·0072	·0076	·0097	·0084	·0073	·0082	·0110	·0199	·0096
New River	·0152	·0576	·0392	·0308	·0280	·0252	·0212	·0133	·0128	·0258	·0228	·0299	·0268
East London	·0291	·0636	·0548	·0624	·0328	·0264	·0344	·0328	·0262	·0425	·0657	·0987	·0474
South Essex	·0096	·0086	·0108	·0070	·0114	·0080	·0120	·0108	·0587	·0098	·0083	·0111	·0138

* Communicated by the Author.

Table D.—Degrees of Hardness (1 *deg.* = 1 *part of Carbonate of Lime, or its Equivalent*) *in* 100,000 *Parts of the Waters.*

Names of Companies.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Thames :—													
Chelsea	21·4	21·1	19·4	21·9	21·1	16·5	16·5	17·4	18·0	18·5	21·1	18·5	19·3
West Middlesex	21·4	19·8	19·7	21·4	21·7	16·2	16·2	16·2	17·2	19·1	21·4	19·1	19·1
Southwark	20·2	20·7	21·0	22·6	21·4	15·7	16·5	16·2	16·8	20·0	21·4	19·4	19·3
Grand Junction	21·1	22·2	20·7	22·8	20·8	16·2	17·1	16·8	18·0	20·2	21·7	19·1	19·7
Lambeth	15·4	21·0	18·5	20·5	21·1	16·8	16·2	17·2	17·4	20·0	22·0	18·2	18·7
Other Sources :—													
Kent	26·5	27·4	27·7	28·5	29·7	25·4	24·5	24·8	26·5	27·4	26·2	23·4	26·5
New River	23·7	22·0	22·5	22·7	21·4	13·7	13·4	13·7	14·0	18·5	20·8	14·2	18·4
East London	24·8	23·1	25·1	22·8	20·8	15·7	16·0	17·7	17·1	20·2	21·7	20·0	20·4
South Essex	25·7	26·5	27·4	27·4	28·5	23·1	23·4	22·2	24·8	25·8	23·7	22·5	25·1

Table E.—Comparative Results in Years 1865 *and* 1866.

Names of Companies.	Year.	Total Solid Impurity.			Organic and other Volatile Matter.			Oxygen required to oxidise Organic Matter.			Hardness.		
		Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.	Max.	Min.	Mean.
Thames :—													
Chelsea	1865	31·72	23·58	26·44	3·05	·72	1·50	·1942	·0328	·0794	18·1	14·5	16·3
	1866	31·72	24·63	27·92	2·59	·70	1·21	·1184	·0340	·0596	21·4	16·5	19·3
West Middlesex	1865	30·63	22·42	26·43	3·07	·96	1·57	·1076	·0304	·0581	18·7	17·1	17·7
	1866	32·02	23·62	27·42	2·00	·72	1·26	·0748	·0304	·0511	21·7	16·2	19·1
Southwark	1865	32·62	18·78	26·89	3·40	·84	1·77	·1972	·0408	·0791	18·9	16·4	17·7
	1866	31·18	23·66	27·88	2·40	·63	1·36	·0866	·0315	·0564	22·6	15·7	19·3
Grand Junction.	1865	32·11	22·94	26·97	2·72	·81	1·54	·1722	·0352	·0636	18·4	16·4	17·7
	1866	31·40	24·82	28·23	1·77	·56	1·19	·0790	·0323	·0532	22·8	16·2	19·7
Lambeth	1865	31·36	22·76	26·41	2·70	·97	1·61	·1950	·0392	·0818	18·8	16·4	17·6
	1866	31·16	25·25	27·82	1·96	·90	1·43	·1288	·0368	·0654	22·0	15·4	18·7
Other Sources :—													
Kent	1865	39·60	34·92	37·79	2·66	·61	1·65	·0692	·0048	·0149	27·4	23·7	25·6
	1866	40·42	37·70	39·03	1·80	·64	1·34	·0199	·0070	·0096	29·7	23·4	26·5
New River	1865	30·02	19·40	25·24	2·00	·54	·98	·0496	·0096	·0251	21·1	17·2	19·3
	1866	29·92	20·20	24·85	1·92	·53	1·05	·0576	·0128	·0268	23·7	13·4	18·4
East London	1865	34·62	22·17	27·98	3·30	·86	1·62	·1341	·0188	·0504	22·2	17·4	20·2
	1866	35·15	24·38	30·48	2·26	·55	1·42	·0987	·0262	·0474	25·1	15·7	20·4
South Essex	1865	43·36	37·68	40·28	2·70	·84	1·82	·0160	·0048	·0103	26·5	21·1	24·2
	1866	40·94	31·32	38·77	2·10	·98	1·55	·0587	·0070	·0138	28·5	22·2	25·1

On a New Mineral from Borneo, by Professor F. Wöhler.

This mineral is found mixed with the native platinum brought from Borneo. It forms small grains or globules of a dark black-grey colour, and of considerable lustre. Many of these grains show brilliant crystalline facets, which are the faces of regular octahedra. The new mineral is very hard and brittle. Its powder is dark grey. Its density exceeds 6, according to an approximate determination. When heated it decrepitates like galena; it does not fuse before the blowpipe, but diffuses a strong odour of sulphurous acid, and then of osmic acid. It is not attacked by aqua-regia, nor by bisulphate of potash. Fused in a silver crucible with hydrate of potash and nitre, it dissolves to a green mass. After cooling the mass is brown, and it dissolves in water with a magnificent orange colour. The solution has the odour of osmic acid, and nitric acid produces in it a black precipitate. From this it may be concluded that the new mineral contains as its principal elements osmium and ruthenium. It also contains sulphur. To estimate the latter, I heated the mineral to redness in a current of hydrogen until no more sulphuretted hydrogen was disengaged. The residue was exhausted many times by aqua-regia; there remained metallic ruthenium. A portion of this metal was estimated in the orange solution. This was evaporated, then neutralised by ammonia and brought to dryness, and the residue calcined in a covered crucible in an atmosphere of carbonate of ammonia. There remained metallic ruthenium. The osmium which volatilised was determined by difference. From this analysis the new mineral contains

Sulphur	31·79
Ruthenium	65·18
Osmium	3·03
	100·00

These numbers appear to show that the mineral is sulphide of ruthenium Ru_2S_3, twelve molecules of which are associated with one molecule of sulphide of osmium OsS_4.

PHYSICAL SCIENCE.

*Mr. Rodwell's Hydraulic Experiments.**

In the former of these papers (an abstract of which was given in the tenth volume of this journal, p. 175), Mr. Rodwell discussed the various modes by which air is carried down by a stream of water, more particularly for the purpose of explaining the action of the Catalan wa terbellows or trompe. The present paper treats of a different branch of hydraulics, and is divided into three parts, of the contents of which we give an abstract below. On account of the length of the paper, it will be impossible for us to do more than describe the general

* "On some Effects produced by a Fluid in Motion," No. iii., *Philosophical Magazine* for February, 1867.

heads of the research, leaving those who are specially interested in the subject to refer to the original.

In the first section the author treats of the "Effects produced by a stream of liquid (α) entering, and (β) issuing from a fluid mass at right angles to its surface." Under this head we have an account of the production of various surface currents, chiefly due to the so-called "lateral action"† of Venturi, which results from the negative pressure of a fluid in motion, for it has been well ascertained, and also demonstrated by Poisson on theoretical grounds, that the pressure exerted by a fluid in motion is less than its pressure when at rest. An explanation of the action of the water elevator, known as the "hydraulic belt," concludes this section.

In the second section we have an account of a number of experiments made to determine the "Amount of lateral action exercised by (α) a jet of water, and (β) a jet of steam of known pressure." The intensity of the action was determined by causing the jet to remove water from a graduated tube by impinging upon the orifice of the shorter limb of a siphon, the longer limb being immersed in the tube, so that the lateral action was exercised against a constantly increasing pressure of water in the longer limb of the siphon, until that pressure balanced the negative pressure of the moving liquid. The lateral action of a jet of high-pressure steam was measured in millimetres of mercury, representing the diminution of atmospheric pressure. Among other results it was found that the lateral action of a jet of steam having a pressure equal to 1165 millimetres of mercury (or 23 lbs. on the square inch) is competent to reduce the atmospheric pressure to one half. For lecture illustrations of lateral action, it is usual to employ air or steam in motion, but the author shows that it may be as readily demonstrated by the use of a fluid in motion, either by means of two appliances which would scarcely be understood without a reference to the figures, or by allowing a liquid "to flow near a sphere of oil floating in static equilibrium in a medium of its own density, when the sphere will be observed to lengthen itself into an ellipsoid, with its major axis at right angles to the direction of the influent jet."

In the third section the author describes some experiments illustrating the constitution of a descending liquid jet below the *vena contracta*. Savart, Plateau, Magnus, and others have proved that the opaque portion of a jet consists of detached masses of liquid, in alternating forms of (α) an ellipsoid with its major axis parallel to the axis of the jet, (β) a sphere, (γ) an ellipsoid with its major axis at right angles to the axis of the jet, (δ) a sphere, and so on. But these effects can only be observed by means of a revolving mirror, or some other contrivance for causing a body in rapid motion to appear motionless, and are therefore unsuited for the lecture table. Mr. Rodwell's object was to modify the experiment so that the above effects could be shown as a lecture experiment. "The mode of effecting this," he writes, "is to cause the cohesion acting upon the particles of a fluid mass floating in a medium of nearly its own density, to slightly preponderate over the gravitating force of the mass, and then, by slowly reducing the density of the medium, to allow gravity to act upon one portion of the mass." The author then describes two methods of showing the experiment, the second of which we give *verbatim*:—

"Prepare, as before, a mixture of alcohol and water" (possessing the same density as the oil employed); "introduce a quantity of oil sufficient to form a sphere from 40 to 50 millimetres in diameter, and let the density of the mixture be such that the sphere floats 20 or 30 millimetres below the surface, the entire depth of the liquid being from 175 to 200 millimetres. On heating the mixture, the sphere extends itself into an ellipsoid with its major axis at right angles to the liquid surface; it then gradually contracts at a point midway between the ends, until, as in the previous experiment, only a fine thread separates the two larger masses of oil; rupture then ensues, and the thread gathers itself into a sphere. The lower mass commences its descent as an ellipsoid having its major axis at right angles to the liquid surface, next becoming a sphere, then an ellipsoid with its major axis parallel to the liquid surface, once more a sphere, and so on, until it reaches the bottom of the vessel, while the upper mass of oil ascends to the surface, and comes to rest as a hemisphere with its plane surface in contact with the surface of the liquid."

The remainder of the paper is devoted to a consideration of the *rationale* of this experiment.

† "Recherches expérimentales sur le Principe de la Communication latérale du Mouvement dans les Fluides."

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, March 27, 1867.

The general section of the following learned societies of France is annually held during Easter week under the patronage of the Minister of Public Instruction, from April 23 to Saturday, the 27th.

The Council of the Scientific Association of France has decided that the general annual meeting for 1867 is to take place at Paris in the same week. In the day meetings will be held, according to custom, by the delegates of learned societies, in which papers only will be read. The Scientific Association reserve for themselves the progress made recently during the last years in different branches of science. M. Haton de la Goupilière is to describe the progress of mechanics; M. Bertin will treat on electricity; M. Lissajoux on acoustics; M. Cazin on heat; M. Troost on chemistry; M. Payen on the fertility of the soil and the means of preserving it; M. Hebert on the general movements of the crust of the earth and their causes; M. Milne Edwards on natural history. This will be a good opportunity for the different juries of the Exhibition of 1867 to meet together, and hold a meeting similar to those of the British Association for the Advancement of Science.

This Scientific Association, following up its own course—to encourage in France works relative to the improvement of the sciences—granted sums of money to M. Cazin, in order to enable him to continue his works relative to the mechanical theory of heat; to M. Bertin, for his studies on the constitution of ice; to M. Bourget, for acoustic apparatus; to M. Crova, for his improvements on Weber's galvanometer; to M. Baudin, for the construction of apparatus for comparing thermometers; M. Terquem, for his acoustic apparatus; M. Favre, of Marseilles, for enabling him to continue his works on physics and chemistry. The Council voted, moreover, a sum of 80*l.* to a gentleman, whose name we did not catch, towards his travelling expenses on his voyage through the interior of Africa; 20*l.* for the purchase of a barometer according to Fortin's method of construction, maximum and minimum registering, and a rain-gauge, which are to be entrusted to the English missionaries for meteorological observations.

We give some details of the photographometer or surveying table applied by M. A. Chevalier and well constructed by M. Duboscq. This instrument, admirably adapted to the use of photography for surveying purposes, operates automatically. Once set up, it takes off mechani-

cally the principal points of the horizon on a plate in a regularly determined time. This object-glass, similar in all respects to that of an 'ordinary' camera obscura, is mounted *vertically* on a circular table or plate, which turns round by clockwork, and can be accelerated or retarded at pleasure. The images of the salient points of the horizon formed by the luminous pencils of rays, which the object-glass renders convergent, cast at an angle of 90°, are made convergent on the horizontal plane by a total reflecting prism, and are thrown upon a perfectly centred sensitised collodionised plate. The whole of the sensitive surface is covered by an opaque screen or shutter, which works round along with the board, and which is provided with a very narrow slit in the middle line situated in the vertical plane passing by the optical axis and that of rotation. Under these conditions, when the complete revolution of the instrument has taken place, the sensitised plate marks exactly the angles made by horizontal lines drawn from the centre of the board or of the station to all points of the horizon which have passed by the optical chamber of the instrument. We can thus, instead of operating continuously, only take off any desired points of the horizon by the method of fixed sections. This contrivance is so adapted that the screen can turn while the object-glass remains fixed, so that the same object can be represented several times in different states of change.

M. Viollet le Duc, the celebrated architect, has had a plan made of the celebrated castle of Pierrefonds, now being restored, in a few days—an operation which would have taken several months by the usual methods.

M. Grenet has discovered the very remarkable fact of the decomposition of a certain number of bodies by the simple passage of a current of inert gas. For example, taking a solution of carbonate of lime, barytes, or potash through which passes a current of nitrogen, hydrogen, or air, the lime, barytes, or potash is precipitated, while the carbonic acid is set free. Under the same conditions, the sulphhydrates of the alkaline sulphides disengage sulphuretted hydrogen; the sulphites and the acetates lose the sulphurous and the acetic acids; the nitrates disengage oxides of nitrogen at temperatures much inferior to those which are generally regarded as the temperatures of decomposition. These phenomena are thus explained:—Taking, for example, the bicarbonate of potash: at ordinary temperature the tendency to dissociation is very weak, and in a limited atmosphere it only emits a feeble quantity of carbonic acid; but if we renew the atmosphere in contact with the carbonate, a fresh quantity of carbonic acid is produced, and the dissociation or decomposition of the salt gradually increases.

M. le Guin, from his latest experiments made with steel from the Imphy Works (Nièvre), on the improvement of the quality of steel in general, and at times by the addition of wolfram or tungsten, has arrived at the following conclusions:—The Bessemer apparatus can be used to combine tungsten with the steel; the loss of tungsten recognised by analysis does not exceed that observed in the processes of combination previously tried; ordinary grey (coke) iron, containing no steel, becomes, by being treated with wolfram, susceptible of being transformed into good steel, the decarburetted metal being in the converters; this opens a great field for the means of obtaining, with cast-iron, a steel of any quality desired; by this means it will be possible to obtain large castings of tungsten steel by the Bessemer process.

The clocks, watches, and chronometers of M. Menon, Rue de l'Eglise No. 10, Neuilly, leave nothing to be desired in the regularity of the marking of time. This is obtained by the compensation of the length of a lever, which acts upon the pendulum by means of rackwork. A metallic rod or wire, curved spirally and vertically *flat*, is fixed to the pendulum; one end is fixed to it, the other is connected with a small lever, the extremity of which is terminated by a small segment of a toothed wheel, which plays upon a rack fixed to the pendulum. When the temperature increases the coil expands, and the rackwork raises the pendulum-rod, and thus keeps the centre of oscillation at a constant point. The reverse effect is obtained when the temperature descends; the coil contracts, and the centre of oscillation is lowered. It is essential that the spiral coil should have exactly the same length and dimensions as the pendulum-rod.

F. Moigno.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, March 21.

Professor W. A. Miller, M.D., V.P.R.S., *President, in the Chair.*

The minutes of the previous meeting were read and confirmed, and the donations to the library announced. Major R. C. Stewart, Mr. J. H. Freeman, and Mr. R. H. Davey were formally admitted Fellows of the Society, and the following gentlemen were balloted for and duly elected—viz., Angus Fraser, M.A. and M.D., Aberdeen; Frederick S. Barff, M.A. Cantab., 16, North Audley Street, Grosvenor Square; and Mr. Alfred Tribe, Great Portland Street, London. The names of candidates read for the first time were—William Phipson Beale, Barrister-at-law, Stone Buildings, Lincoln's Inn, and Alfred Coleman, Plough Court, Lombard Street. For the second time were read the names of David Skinner Kemp, Bombay, and John Mackay, 119, George Street, Edinburgh.

Dr. J. H. Gladstone offered a few remarks "*On Phosphonitril.*" The body in question, PNO, was produced by heating the product of the action of ammonia gas upon the oxychloride of phosphorus. Its formation was thus explained:—

I. $PCl_2O + 2NH_3 = PNH_2Cl_2O + NH_4Cl$.
II. $PNH_2Cl_2O = PNO + 2HCl$.

The author had ascertained the loss by heat in the second equation, and found it to be 32·45 per cent., which was close upon the number demanded by theory—viz., 32·36. It is a white, solid, and very stable compound, fusible to a vitreous mass at high temperatures; not attacked by the ordinary acids or alkalies, but decomposed only by concentrated sulphuric acid. An analysis was made of it by fusion with carbonate of sodium and nitre, and this gave 50·73 per cent. of phosphorus instead of 50·82. Dr. Gladstone humorously said this was a compound that had more names than investigators, and he was now desirous of canvassing the Society as to the propriety of adopting for it the name of "phosphonitril." It had previously been called "phosphamide" and "biphosphamide," but it did not contain any hydrogen. The speaker then showed its mode of formation from the metaphosphate of ammonia by loss of two atoms of water, thus—

$$P(NH_4)O_3 - H_2O = PNO.$$

Mr. T. Sterry Hunt said that fifteen years ago he inserted a notice in *Silliman's Journal* referring to the constitution of this body, and described it under the old formula PNO_2. He then viewed it as the nitril of phosphoric acid, and compared it with NO, the nitril of nitric acid.

Mr. James Parkinson then read a paper "*On the Phosphide of Magnesium.*" The author described the formation of this body under a variety of circumstances and with the use of different kinds of phosphorus. He pointed out the error of employing carbonic acid for filling the apparatus prior to the volatilisation of the phosphorus and passage of its vapour over magnesium filings, as practised by Mr. T. P. Blunt; and denied likewise the stable character which had been attributed to the phosphide. Mr. Parkinson showed the case with which it decomposed water

(with brisk effervescence) at the ordinary temperature, and demonstrated the change into phosphide of hydrogen and hydrate of magnesia, which occurred as the result of drawing a current of moist air over the finely divided phosphide of magnesium. A small quantity of hypophosphite of magnesium seems also to be formed during the process of oxidation. The phosphide is described as a hard, brittle, difficultly fusible substance, steel-grey in colour, but usually exhibiting a dark brown exterior resembling the surface of a "clinker." Its analysis confirmed the formula previously given—viz., Mg_3P.

Mr. Spiller referred to the circumstances under which he had prepared the phosphide of magnesium, and to the fact of his having arrived at the same formula as that originally stated by Mr. Blunt, and now confirmed by the more exact experiments of Mr. Parkinson.

A large and very fine specimen of frozen glycerine was then exhibited by Dr. W. S. Squire, who stated that it was a portion of five tons of that article which he had imported from Germany during the severe weather of the past winter. It was packed in 8-cwt. casks, and the contents of all of them proved to be quite solid, and of a light brown colour, on their arrival in England. The sample exhibited was a portion which had not yet been liquefied; its snow-like aspect was due to the removal of the colouring matter in the process of draining off the liquid portion. No sugar or any other known crystallisable matter could be detected in the glycerine—in fact, no impurity whatever, excepting about 5 per cent. of water and a trace of colouring matter. The solid was slightly heavier than the liquid portion, their relative gravities being 1·268 and 1·26. The speaker had been unable to procure again solid glycerine by exposing the liquid drainings from this sample to intense cold in the laboratory; even a journey by railway to Edinburgh and back during the recent hard frost failed to have any effect in determining its crystallisation. Ice and salt, besides other freezing mixtures, had been tried, but with no other result than making it very viscid, and fragments of the solid dropped in did not lead to any result. Some of these facts had been already published by Mr. Crookes in the Chemical News,* but Dr. Squire felt sure that the inspection of such a chemical curiosity would be interesting to the meeting.

The President proposed a vote of thanks to Dr. Squire for bringing the subject so prominently to the notice of the Society.

Dr. De la Rue said he had observed the unusually low temperature of −6° Fahrenheit at West Drayton about the time of the transmission of the glycerine to Dr. Squire. He felt considerable interest in hearing of the manufacture of this substance in such large quantities, since he believed his late father was one of the first to call the attention of chemists to the expediency of economising the glycerine in the process of soap-making.

The President adjourned the meeting until the anniversary on the 30th instant, and announced that at the next ordinary meeting on April 4 Dr. Russell would read a paper "*On Gas Analysis.*"

ROYAL INSTITUTION.

A Course of Six Lectures "*On Coal Gas*," by Dr. Frankland, F.R.S. (Lectures V. and VI.—March 21 and 23, 1867.)

The Impurities—Injurious Effects of Carbonic Acid; of Ammonia—The Purification of Coal Gas—The Diluents—The Illuminants—Conditions involved in the Generation of Gas possessing high Illuminating Power—Temperature of Distillation—Comparison of the Metropolitan Gas Supply with that of other large Towns.

The subject of impurities, it will be remembered, was commenced in the fourth lecture. The lecturer now explained that carbonic acid was not only useless as an illuminant, but detrimental to the light yielded by the other constituents of the gas. It produced this result by oxidation of the hydrocarbons, and consequently was itself reduced to the state of carbonic oxide. During this reduction, heat was abstracted from the flame to the extent of 2732° Fahr., which of course greatly lessened the luminosity. Mr. Barlow, who investigated this subject, found that 1 per cent. of carbonic acid reduced the luminosity by about 7 per cent. (London gas at present contains about 2 per cent.) The effect of this impurity was illustrated by burning two flames side by side, one containing about 2, and the other 10 per cent. The difference in luminosity was very evident.

Nitrogen is found in all coal, and varies from ¼ to ½ per cent.; during the distillation, the hydrogen generated combines with it, forming ammonia. Ammonia, if existing in gas, would, during combustion, form water, nitrogen, and minute quantities of nitric and nitrous acids. By Act of Parliament, this impurity is not allowed to be present in gas in quantity sufficient to brown turmeric paper when submitted to its action for a minute; the gas supplied to the Institution browned turmeric paper in less than this time. With regard to the removal of ammonia, there is no difficulty, owing to its great solubility in water, but some manufacturers purposely leave it in, as it is believed to prevent the deposition of naphthalin in the mains.

Much attention has been paid to the removal of sulphuretted hydrogen, which is confessedly the worst of the impurities. Hydrated oxide of iron is now used for its removal, in the place of hydrate of lime, which was formerly used for the purpose.

The chief advantage of this change is that the hydrate of iron, after having withdrawn the sulphuretted hydrogen, may be reconverted into the hydrate by simple exposure to the air. After being used a great many times the material is distilled to utilise the sulphur it contains.

Though the employment of hydrate of iron is a saving to the manufacturer, the quality of the gas is worse in two respects than when the hydrate of lime is used. The latter purifier separates carbonic acid as well as sulphuretted hydrogen, and the compound formed with the sulphuretted hydrogen is capable of uniting with and withdrawing a certain quantity of bisulphide of carbon from the crude gas.

A new process for determining the amount of sulphur in coal gas has lately been devised, which gives nearly double the amount obtainable by the method at present used. A table giving the results of a number of trials, in which the sulphur was estimated by the ordinary methods, showed in a large number of cases more than 20 grs. of sulphur to the 100 cubic feet (the maximum amount allowed by Act of Parliament); and, according to what we have already recorded, this only represents about one-half of the amount present! Dr. Frankland explained that the Act of Parliament was perfectly inoperative. Gas is impoverished in illuminating power by transmission through long systems of mains, partly by the condensation of previously vaporised hydrocarbons, and partly by the exchange of hydrogen for atmospheric air by diffusion. The diluents contribute indirectly to illumination—in the first place, by taking up volatile hydrocarbons in the state of invisible vapour. An experiment in illustration of this fact was made thus:—A supply of hydrogen was divided into two portions, and one portion during its passage to the flame came in contact with tow soaked in benzol; the luminosity of the latter was in striking contrast to the feebleness of the hydrogen flame.

Secondly, one of the diluents, marsh gas, under peculiarly favourable circumstances, may become an illuminant. A flame supplied with ordinary marsh gas was compared with one burning marsh gas which had been passed through a tube heated in a charcoal furnace.

* *Vide* page 26 of the present volume.

The following facts (exhibited in a diagram) are some of the most important in reference to the diluents:—

1 cubic foot of hydrogen, at 60° F. and 30 in. bar., consumes ½ cubic foot of oxygen, generates no carbonic acid, and heats 1 lb. 13 oz. of water from 32° to 212° F., or 2500 cubic feet of air from 60° to 66·4° F.

1 cubic foot of carbonic oxide, at 60° F. and 30 in. bar., consumes ½ cubic foot of oxygen, generates 1 cubic foot of carbonic acid, and heats 1 lb. 14 oz. of water from 32° to 212° F., or 2500 cubic feet of air from 60° to 66·6° F.

1 cubic foot of marsh gas, at 60° F. and 30 in. bar., consumes 2 of oxygen, generates 1 of carbonic acid, and heats 5 lb. 14 oz. of water from 32° to 212° F., or 2500 cubic feet of air from 60° to 80·8° F.

The illuminants contained in coal gas were given as the following:—Olefiant gas (ethylen), propylen, butylen, caproylen, acetylen, benzol, toluol, cymol, &c.; also hydrides of hexyl, octyl, and decyl.

Nearly all the illuminating power resides in the ethylen series. To prove this, gas containing the bodies given above was brought in contact with bromine (which absorbs this series). After this treatment there was scarcely any luminosity.

Acetylen is always a constituent of coal gas. It may be produced in various ways. Marsh gas yields acetylen when submitted to a high temperature. Coal gas, by the action of the induction spark, was shown to yield acetylen. M. Berthelot's process of combining the elements directly, and Mr. McLeod's process of burning air in coal gas, which yields acetylen in quantity more readily than any of the others, were brought forward. The production of the red acetylide of copper, and its explosiveness were both exhibited. The great value of acetylen as an illuminant was shown by experiment.

With regard to the temperature of distillation, a cherry-red heat was said to be the proper temperature; higher than this the volume of gas is increased, but is of worse quality; a lower temperature gives too small a volume of gas. A table comparing the cost of gas with other illuminating materials for the same amount of light showed the great economy of gas over them all.

In conclusion, Dr. Frankland remarked on the bad quality of the gas supplied to London. He thought the public were not fairly treated by the gas companies. Sixteen years ago he had examined the London gas, and now he found it to be considerably worse than it was then. Had there been no improvements in this direction since that time? Undoubtedly there had, and any invention which decreased the cost of manufacture was eagerly seized, but those relating to improving the quality of the gas were entirely ignored. To obtain the same amount of light in London as is obtained in Edinburgh, it is necessary to burn twice as much gas, to put up with twice as much heat caused by its combustion, and to inhale ten times as much sulphurous acid. No gas ought to be considered good enough for use which did not give a light equal to twenty standard candles when burning 5 cubic feet per hour.

QUEKETT MICROSCOPICAL CLUB.

The monthly meeting was held at University College on the 22nd inst., Ernest Hart, Esq., President, in the Chair.

A paper was read by Mr. C. A. Watkins on "*Yeast and other Ferments.*" The matter was treated broadly, and the author explained the similarity of the chemical operations of all ferments, whether they be living organisms, as yeast, or substances derived from organic sources, as albumen, casein, diastase, &c., and urged the necessity of considering these operations together, rather than separating them into those which are the results of organic growth and those which appear to be simply chemical actions. The changes in each fermentation were indicated by a diagram of the chemical formulæ. In describing the transformation of starch into sugar, sugar into alcohol, &c., he pointed out the albuminous character of the ferments, and showed how necessary such matters are for the healthy growth of yeast; and in describing the viscous, lactic, and butyric acid fermentations, and also the ordinary conversion of alcohol into vinegar, he called attention to the universal appearance of the minute Bacteria and Vibriones which accompany these changes, and invited microscopists to the study of these low forms of life, that some light may be thrown on the relation they evidently bear to the various phases of decay of organic products generally.

Ten members were elected, and the proceedings terminated with a *conversazione*.

ACADEMY OF SCIENCES.

(From our own Correspondent.)

March 18, 1867.

M. Henri Sainte-Claire Deville communicated some quite new experiments by M. H. Debray in order to demonstrate that chemical decomposition is analogous to the evaporation of a liquid in this sense—that the tension of the gas proceeding from the decomposition is constant. He operated upon pure carbonate of lime, Iceland spar, or ordinary impure carbonate of lime, placed in the middle of a tube communicating sometimes with a mercurial pump and sometimes with a gauge apparatus for measuring the tension of the carbonic acid disengaged by the decomposition. The carbonate was alternately submitted to four constant temperatures—360° C. vapour of mercury, 440° vapour of sulphur, 660° vapour of cadmium, 1040° vapour of zinc. It was found that at 360° the vapour of the carbonic acid was absolutely *nil*; at 440° it was hardly sensible; at 660° it was only 85 millimetres; at 1040° it attained 551 millimetres. Under each of these temperatures the tension was also constant, and the results remained the same when they passed from the pure carbonate to the impure.

Equally curious researches by M. Jules Regnauld, and also presented by M. Sainte-Claire Deville, were made in order to resolve these two questions:—1. Is the union of thallium with mercury accompanied by a disengagement or an absorption of heat? 2. Is amalgamated thallium more or less electro-positive than pure thallium? Very accurate experiments gave the following results. There is elevation of temperature, and thus a disengagement of heat, during the formation of the amalgam of thallium and mercury. Pure thallium is electro-positive to the amalgamated thallium. The experiments of M. Regnauld prove that the position of thallium is remarkably lower than that which separates cadmium from zinc in the Daniel couple. They confirm this general proposition—"Every time that a metal is united to mercury, the place which it occupies in the scale of affinities is modified, and thermo-phenomena are observed."

M. Blanchard presented a *crab*, of a species which is found on our coasts, brought from Japan, and from the collection of Von Siebolt, which had attained a gigantic size. Its arms measure 1·20 m.; its breadth across the claws is more than 2 metres. For the crustacea, it is not full-grown; the development increases with the age, and if the sea is very calm the proportions it takes are enormous.

M. Jansen, who went to Tarni, in the Kingdom of Naples, to observe the annular eclipse of the sun on March 6, has proved that the spectrum of the annular rays did not contain more black lines than that of the full sun.

M. Duboscq presented a new photographic planchette by M. Auguste Chevalier.

M. Dumas presented nodules of anthracite, obtained by the Count de Douchet, almost as hard as the black diamond; it is composed of carbon 97, hydrogen 0·50, oxygen 1·50; its specific gravity is 1·65.

M. Louis Daniel, Professor of Physics at the central School of Arts, communicated a curious experiment on the transporting of substances by the voltaic and induction current. It is generally admitted that the current of the pile moves, in the interpolar circuit, from the positive to the negative pole. The existence of a mechanical action exerted in this direction is confirmed by the movement produced in the carbon by the voltaic arc. It is evident, also, from the difference of level which takes place, under the influence of a current, in a vessel divided into two compartments by a porous diaphragm, and enclosing a liquid of weak conductivity, which, at the commencement of the experiment, presents two surfaces of equal height at each side of the separation. This movement of the liquid by the current, discovered by Porret, has been examined by Messrs. De la Rive, Becquerel, and latterly by Windemann, who has determined its laws under certain conditions.

It is possible to place in evidence this action of electricity, and to show the direction by an experiment more simple than the preceding. If we electrify water in a glass, of which the bottom is rather wide, rounded in the middle, and if a drop of mercury be dropped in, it will be seen that the globule runs away from the positive electrode when it is pushed towards it. Thus, by properly displacing the electrode, we can give to the electrode a movement of rotation. It is the observation of this phenomenon which has led him to the experiment which M. Daniel describes. He fills with slightly acidulated water a glass tube of any length, and of a diameter from ten to fifteen millimetres, bent at a right angle at its two extremities. He introduces into the liquid column a globule of mercury two or three centimetres long, and he plunges into the two vertical portions the electrodes of a more or less powerful pile. By means of the globule of mercury he easily levels the instrument.

As soon as the current passes, *the globule becomes elongated* and *begins to move; it goes from the positive to the negative pole.*

If, by means of a commutator interposed in the circuit, the direction of the current be changed, the globule *stops and immediately takes an opposite direction*, always from the positive to the negative pole.

By properly manœuvring the commutator, we can make the mercury take an indefinite alternating motion. The ends of the globule, under the influence of the current, do not present the same appearance. It is brilliant towards the negative electrode, and dull towards the positive one. This is owing to its being polarised like the whole column of the liquid; it possesses positive tension in front and negative tension behind. The oxide of mercury formed during the experiment is collected at the negative end, and is reduced, at least in part, by the hydrogen produced at the same time. If the liquid contain too much acid, a salt is formed which disturbs the transparency of the column, and bubbles of hydrogen are disengaged. When the direction of the current is altered, a sort of veil which covers one of the extremities of the globule is seen to fly to the other extremity.

Four Bunsen elements suffice for this experiment if we employ a tube 0·40 m. to 0·50 m. long. With twenty-four elements we can operate upon a tube a metre long. The current of fifty elements gives too great a velocity to the mercury, and breaks it up into globules which travel in the same direction. When the tube is inclined, the mercury can still move from the lower to the upper end. Thus, the weight of the mercury being known, we can form a very clear idea of the work performed by the portion of the current which traverses the globule. If the inclination be progressively augmented, a moment arrives at which the equilibrium is established between the force of the current, which tends to make the mercury ascend, and the action of the weight, which causes it to descend, the globule rests stationary, but it is elongated. It is always subject to a very apparent interior movement, and it takes a rotatory motion, first in one direction, then in another.

The same experiment can be made by means of a Ruhmkorff's coil. As the currents furnished by this apparatus are alternately in contrary directions, a commutator is necessary in the interpolar circuit, so as to suppress the inverse current. It is important to remark that the conductivity of the transported material is one of the necessary conditions of the movement; a globule of sulphide of carbon introduced into the tube is insensible to the passage of the current.

In this experiment it is a mechanical action exercised by the current which produces the movement of translation; the pressure exerted by the hydrogen which is disengaged at the negative end of the globule acts a prominent part in this phenomenon.

NOTICES OF BOOKS.

Photographs of Eminent Medical Men. Edited by Wm. Tindal Robertson, M.D., M.R.C.P. Photographic Portraits from Life, by Ernest Edwards, B.A. Cantab. London: J. Churchill and Sons, New Burlington-street; Ernest Edwards, 20, Baker-street, Portman-square, W. Volume II., No. 1.

The second volume of Photographs of Eminent Medical Men commences very well; each part of the work (price 3s.) contains three excellent photographs, with a contemporary notice, of from two to six pages, of the eminent men whose photographs are given. The success of such memoirs must depend (as the late editor remarked) upon "the exclusion of all controversial passages and of all such details as belong only to private life." The present editor, Dr. Robertson, sees no reason why a brief sketch of some of those who have recently passed from amongst us should not be introduced into the series. That there can be no such objection will be allowed by all who read the biographies of this kind that appear in the *Proceedings* of the Royal Society. There is a fellow series to this one also published, "Photographic Portraits of Men of Eminence in Literature, Science, and Art," in the back numbers of which have appeared notices of Faraday, Tyndall, Miller, Graham, De la Rue, and other eminent chemists; also Dr. William Farr, Sir J. Clark, Dr. Latham, and other physicians; while we find the following names in succession: Sir De Lacy Evans, Professor Partridge, Martin Tupper, and the Lord Bishop of Lichfield,—a very instructive association of great names in literature, science, and art. We would urge the editor to avoid encroachments upon this work which we have just noticed, the photographs of which are taken by the same artist; for if the schemes of the two series are kept distinct from each other room will be left for future ones to appear without repetition. Portraits contained in the literature and science series, as those of Sir James Clark and Sir William Fergusson, would be more judiciously placed in that of "medical celebrities," for their fame is of a medical character; while those of Professor Huxley and Dr. Bence Jones should appear in the former rather than in the latter work, from their discoveries being mostly made in quite different fields. Lastly, for the success of this work to be complete, we would remind the editor that portraits are announced of eminent medical men of all countries. The present Part contains portraits of Professor Huxley, Dr. Bence Jones, and Dr. Cowan; the next will give us portraits of Mr. Lawrence, Dr. Gardner Hill, and Dr. Ranking. Excluding the first two as not being strictly medical, we would suggest that, great as are the names of the other gentlemen in the list, and world-wide as may be their reputation, there are also foreign names, as those of Civiale, Skoda, Trousseau, that are certainly quite as well

known, and in the first two parts of Volume II. eminent medical men *of all countries* are not properly represented. These things, however, admit of very easy remedy, and we are sure that the justice of our remarks will be recognised; and when we call to mind the fact that on the Continent, in museums and libraries, our own scientific celebrities are so frankly recognised and placed in such flattering company, such exclusion of foreign physicians almost appears a want of courtesy. Two out of the three portraits of the present Part, about which we can give any opinion, are excellent; we allude to those of Professor Huxley and Dr. Bence Jones. Of the latter gentleman we know of none better. The memoirs are also valuable, from their clearness of expression, and conciseness at the same time. We could place fuller reliance upon the information supplied if we were more assured of its accuracy in every case: *e. g.*, in speaking of Professor Huxley, the editor says, "in 1845 he took the degree of M.B. at the University of London, with honours in physiology;" wheas the truth is that in the *Calendar* Mr. Huxley figures only as an undergraduate. Many of our readers owe much to this eminent teacher at the Royal School of Mines, and we can recommend this portrait to them. That of Dr. Bence Jones, whose name is so closely connected with English chemistry generally, and the Royal Institution especially, cannot fail to be interesting to all of them. We should think that there is at the present time a good opening for a series of eminent chemists, and to no one could the execution of the portraits be more safely entrusted than to Mr. Ernest Edwards.

Chemical Manufactories Directory of England. 1867. London: Kent and Co., Paternoster-row. Price 2s. 6d.

This directory appears for the first time, and the manufacturers of England are alone enumerated, no mention being made of the Irish and Scotch works. It contains twelve pages of addresses and three more for the index, one for the preface and contents, one for advertisements. Its price is half-a-crown! and it certainly would not be a cheap book if sold for sixpence. The specialties of the manufacturers are also given. From this we learn that Messrs. Condy are manufacturers of *various sanitary chemicals*. Another chemist makes creasote and *carbonic acid*.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Comptes Rendus. February 18.

H. Deville and L. Troost "*On the Composition of the Chlorinated and Oxygenated Compounds of Niobium and Tantalum.*"—Chevrier "*On some Properties of Chloride of Sulphur.*"—M. E. Chevreul: "*Analysis of the Earth from certain Bone Caves.*"

February 25.—H. Fizeau "*On the Property possessed by Iodide of Potassium of Contracting by Heat and Expanding by Cold.*"—H. Deville "*On the Properties of Iodide of Silver.*"—A. Morin: "*Note on an Electric Registering Thermometer.*"—Bussy and Buignet "*On the Alteration in Temperature caused by the Mixture of different Liquids.*"—Daubrée: "*Experiments on the Chemical Decompositions caused by Mechanical Action in Felspathic Minerals.*"—Secchi "*On the recent Disappearance of a Lunar Crater, and on the Spectra of certain Stars.*"—C. Friedel and A. Ladenburg "*On some Silicium Compounds, and on the Analogies of that Element with Carbon.*"—O. Ordinaire "*On a Brominated Derivative of Phosphorous Acid.*"—J. M. Gaugain "*On Mr. Grove's Gas Battery.*"—L. Daniel "*On some Electro-Magnetic Induction Experiments.*"—E. Baudrimont "*On the Action of Chloride of Sulphur on Metals and Metallic Sulphides.*"—Preterre "*On the Danger of using Protoxide of Nitrogen as an Anæsthetic.*"

Annales de Chimie et de Physique. February, 1867.

E. Mathieu "*On the Dispersion of Light.*"—J. Kolb "*On the Density of Nitric Acid.*"—C. Matteucci "*On Electrical Earth Currents.*"

Bulletin de la Société d'Encouragement. December, 1866.

Duchesne: "*Report on C. Groult's Manufactory of Alimentary Products.*"—"*Universal Exhibition of 1867: Imperial Decree nominating the French Jury for Groups 2 to 10 (Industrial and Agricultural Products), and for the New Prizes instituted by Imperial Decree of June 9, 1866.*"—"*Universal Exhibition of 1867: Special Jury for the New Prizes instituted by Imperial Decree of June 9, 1866.*"—"*A Method of Preventing the Breaking of the Glass Chimneys of Petroleum Lamps.*"—Artus "*On a Method of discriminating Beetroot Spirit and for removing the Empyreumatic Odour therefrom.*"

Bulletin de la Société Industrielle de Mulhouse. December, 1866.

"*List of Prizes offered by the Society.*"

January, 1867.—E. Zuber: "*Annual Report, List of Members, Balance-sheet, Résumé of the Proceedings of the Society.*"

Mittheilungen des Gewerbe-Vereins für Hannover. Nos. 5-6. 1866.

Begemann "*On Milk, and on the Methods of Estimating its Value.*"—A. Ronna "*On the Utilisation of Sewage in England, London, and Paris.*"—A. Stromeyer: "*Remarks on the above paper.*"—K. Karmarsch: "*Review of J. Wiesner's 'Introduction to the Use of the Microscope in Technical Investigations.'*"

CORRESPONDENCE.

Standard Thermometers.

To the Editor of the Chemical News.

Sir,—As a letter written in error to the *Times* on Jan. 16 relative to a thermometer sold by us to the Rev. Cooper Key has given rise to a lengthened correspondence in your journal, we think it but right that you should know how the affair has terminated, and, without troubling you with a long letter, we will simply give an extract from the Rev. C. Key's last communication, in reply to a letter sent to him on March 15. He says:—

"Gentlemen,—Your letter of this morning has much surprised me, as I had concluded long ago that Mr. Glaisher had informed you of the course I had already taken, which was to write to the *Times* explaining my original error in comparing the two instruments, stating I had sent the instrument to Kew in order to set the matter of its true corrections at rest, and giving the table of those corrections."

The following is a copy of a letter received from the Kew Observatory:—

"Kew Observatory, Feb. 16, 1867.

"Dear Sirs,—On my return from the North this morning, Mr. Whipple has informed me of a correspondence he has had with the Rev. H. Cooper Key and yourselves regarding the accuracy of your thermometer No. 7381 maximum. It appears that Mr. Key, having compared this instrument with a thermometer verified at Kew, thought he noticed a much greater difference in the two instruments than the correction for No. 7381, furnished by Mr. Glaisher, would have led him to suppose. In

other words, he thought he had discovered a difference between the methods of testing thermometers pursued at Greenwich and at Kew. Mr. Whipple and Mr. Baker, assistants at Kew, and your Mr. Zambra, made the comparison of the instrument with the Kew standard, and found a result agreeing as nearly as possible with that of Mr. Glaisher. Mr. Key has been induced to repeat his observations, and in a letter subsequently received by Mr. Whipple from him he mentions that he has obtained results agreeing with those found at Greenwich and at Kew. "Yours very truly,

(Signed) "B. Stewart.

"Messrs. Negretti and Zambra."

From the above it will be seen that the problem of $2\frac{1}{2}°$ index error which is being discussed by your readers is best solved by the simple fact that it did not exist at all.

We are, &c.

MM. Negretti and Zambra.

To the Editor of the Chemical News.

Sir,—My letter to you about Standard Thermometers has called forth some counter remarks from "A Subscriber," and you will perhaps kindly allow me a small share of your valuable space for a reply. The gist of "A Subscriber's" letter is—first, that the explanation adduced by me for the index error of thermometers is not new; and, secondly, that it is not sufficient. Now, I claimed by no means novelty for the explanation given in my letter; on the contrary, I mentioned it as perfectly well known, just because "A Subscriber" said in his first letter that Mr. Pastorelli "believes this increasing error owing to the contraction of the glass after its manufacture," which, taken in conjunction with the rest of the paragraph, seems to be given as a novel explanation.

As to the second part, "A Subscriber" contends that the one-sided pressure of the atmosphere and the molecular change brought about in the glass by the heat and force of the boiling mercury (that I meant this he sees very well himself, and he might accordingly have left out the first part of his letter containing a refutation of an opinion not at all held by me) are not sufficient to account for the extent of error—viz. 2° (C. or F.?) He refers me, in that respect, to "books," without mentioning any in particular; to some nameless practical manufacturer who computes the amount of the one-sided pressure only at 0·4°; and to observations of his own, apparently published nowhere, as to the influence of the boiling mercury on the glass. Perhaps he is right; but who can be convinced of that by those vague references without chapter and verse? As far as I am concerned, I have the least possible objection to be convinced, and to learn from the "Subscriber's" and Mr. Pastorelli's experiments; but so long as those are not published they can scarcely be claimed to be authoritatively decisive on such a nice experimental subject on an anonymous assertion. I should be as thankful for their publication as any one, and I heartily join in your desire expressed at the close of "A Subscriber's" letter. I am, &c. G. L.

Sulphate of Soda in Glass-making.

To the Editor of the Chemical News.

Sir,—The vast plains covered with sulphate of soda were given by the Government to particular persons. A great deal of this useful mineral lies in plains, and frequently covers the banks of lakes. The rough sulphate of soda, or gudjir, is employed in Transbaikal principally for soap and glass fabrication. Being on the glass manufactory near Irkoutsk, belonging to the merchant I. G. Schwedoff, we spoke about the properties of gudjir. I am now occupied with its analysis; he tells me that, notwithstanding all efforts and experiments made for decolouring the glass mass, the green bottle-colour appears very strong. Now, Sir, I beg you humbly to indicate to me the manner of decolouring the glass, or a practical method of completely separating the protoxide and oxide of iron. What is the price of 1 kilogr. of titanium, and for what purpose is it employed in glass fabrication? How to augment the colouring quality of peroxide of manganese? In small quantities it does not act, but being employed in a greater quantity the gudjir glass appears a black-reddish.

I am, &c. A. Lomonossoff,

Civil Officer of General Governor of East Siberia.

Irkoutsk, East Siberia, February $\frac{22}{10}$, 1867.

[If some of our readers will kindly give the information asked in the above communication, we shall have great pleasure in forwarding it to our Siberian correspondent. —Ed. C. N.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Urea: its Constitution.—H. Kolbe. Urea is ammonia in which H_1 is replaced by carbamyle $(C_2O_2,H_2N)'$; it is metameric with carbamide, a diamine in which H_2 are replaced by $(C_2O_2)''$. Although ammonias in which hydrogen is replaced by an oxacid radicle are indifferent bodies or weak acids—an observation which renders it probable that carbamide is an indifferent body—yet amido derivatives of even strong acids possess basylous properties, so that we need not be surprised that urea is capable of uniting with acids. Urea results from the union of two molecules of water and one molecule of cyanamide, the cyanogen in the latter body interchanging elements with the water to form carbamyle: a simple change in the position of the elements converts ammonic cyanate and also carbamide into urea. Ethylic carbamate reacts with ammonia to form urea and alcohol in a manner precisely analogous to that in which other compound ethers interact with ammonia. Biuret is ammonia in which H_2 are replaced by two molecules of carbamyle; the usual view that it is a triamine has little probability. Compound ureas formed by the action of primary or secondary ammonias on cyanic acid, or its compounds with alcohol radicles, arise from the replacement of hydrogen in the ammonia by a primary or secondary carbamyle formed by the union of that hydrogen with the cyanic acid or its alcohol radicle compound; hence, if the secondary ammonia employed—*e.g.*, triethylamine—contains no such replaceable hydrogen, an urea cannot be formed by it, a conclusion supported by experiment. But if urea be carbamide there seems no reason why triethylamine should not give triethylurea as easily as diethylamine gives diethylurea. It will be seen that, according to the theory here propounded, the urea resulting from ethylic cyanate and ethylamine is isomeric with, but different from, that formed by cyanic acid and diethylamine; and experiment shows that, if boiled with potash, the former gives ethylamine, and the latter diethylamine. Experiments are in progress to decide whether both the typical hydrogen atoms in urea are directly replaceable by ethyl. The application of the above views to the formation of ethylene urea from cyanic acid and ethylene diamine is simple.

Kreatine is urea in which one typical hydrogen atom is replaced by the radicle of methylamidacetic acid (sarkosine), and experiment shows that if kreatine is boiled with baric hydrated oxide it is split into sarkosine and urea; if the converse reaction to that which produced urea from cyanamide be hypothesised, the formation of kreatinine from kreatine occurs by splitting the carbamyle in kreatine into cyanogen and water, and kreatinine becomes cyanamide, having H_1 replaced by sarkosine.—(*Zeitschr. Chem.*, N.F., iii. 50.)

Nitric Acid, Density of (O=8).—J. Kolb. A number of determinations taken at different temperatures

showed that the maximum contraction of nitric acid corresponds exactly with NO_5+7HO : the coefficient of expansion between 0° and 15° is 0·001263—about three times that of water. The density was taken by sp. gr. bottle, and the quantity of acid determined by adding to the diluted acid an excess of dried and weighed calcic carbonate, the undissolved residue of which was weighed back. A table partly interpolated accompanies the paper. —(*Ann. Chim. Phys.*, S. 4, x. 136.)

Bichlorodi-isopropyl (C = 12).— C. Schorlemmer. The body obtained by acting on di-isopropyl with chlorine in presence of iodine is $C_6H_{12}Cl_2$.—(*Zeitschr. Chem.*, N.F., iii. 75.)

Aceto-silicic Anhydride (C = 12, O = 16, Si = 28).— Friedel and Ladenburg. To a mixture of monohydrated acetic acid and acetic anhydride rather less than the proportional quantity of silicic chloride is added; the mixture is boiled as long as chlorhydric acid is evolved; on cooling the anhydride crystallises out, and, after washing with anhydrous ether, is pure. It is the first crystallisable organic compound containing silicium. It is white, decomposes at about 165° under normal pressure, but may be distilled at a pressure of five or six millim. at 148°; it melts at about 110°. Its formula being $SiO_4(C_2H_3O)_4$, it corresponds exactly to Ebelmen's ethylic silicate, $SiO_4(C_2H_5)_4$.

Friedel and Crafts described (*Ann. Chim. Phys.* [4], ix. 5) an ethylic derivative of this anhydride of the constitution $SiO_4(C_2H_5)_3(C_2H_3O)$, obtained by heating ethylic silicate with acetic anhydride. (*Comptes Rendus*, lxiv. 84.)

Thiosinamine, some derivatives of (C = 12, O = 16). —Dr. R. L. Maly. By adding a slight excess of bromine to an alcoholic solution of thiosinamine and concentrating the solution, crystals are obtained soluble in alcohol and water, fusing at 146° to 147°, having the composition $C_4H_8N_2SBr_2$, and a name thiosinaminic bibromide. If a known quantity of this body is shaken with a known quantity of fresh argentic chloride in water, the silver compound washed and weighed, and the quantity of bromine in it calculated, it is found that one-half of the bromine in the organic compound has been replaced by chlorine with production of thiosinaminic bromochloride, crystallisable from alcohol, fusing at 129° to 130°, and containing a group BrCl with the functions of a hydracid. The bibromide combines with platinic chloride, and, if treated with auric chloride, forms a yellow precipitate, which in a few seconds becomes purple and crystalline, with an accompanying exchange of bromine and chlorine between the metallic and organic bodies, the final result being $C_4H_8N_2SBrCl.AuBr_3$, which, when crystallised from hot water, is a very fine but unstable body.

Bromothiosinaminic hydrated oxide is made by decomposing thiosinaminic bibromide with argentic hydrated oxide; it is uncrystallisable from water, bitter and astringent, and strongly alkaline; it is decomposed by chlorhydric acid, thiosinaminic bromochloride being produced.

Thiosinaminic bibromide may be viewed as ammonic chloride in which HCl is replaced by BrBr; if treated with cold concentrated sulphuric acid, bromhydric acid is given off, the hydrogen of which is evidently derived from the sulphuric acid. Passing now to the more simple body ammonic chloride, and examining its behaviour with sulphuric acid, it is seen that the chlorhydric acid evolved may be supposed either to exist as such in H_3N,HCl, or to be produced by the mutual action of $2(H_4NCl)$ and H_2SO_4. Analogy suggests that the latter is the more correct view. (*Akd. z. Wien*, 54 [1866]).

Glass.—J. Pelouze. Glass containing a very large proportion of silica is remarkable for the ease with which it becomes devitrified by heat; such a kind of glass was found to have a low refractive power, but about the same dispersive power as ordinary crown of St. Gobain. Glass containing alumina is by no means readily devitrified; it is generally coloured, because lime necessary to take up the alumina, if in any quantity, forms with it a compound which attacks the crucibles. It appears to be of low refractive power. Glass containing magnesia is even more easily devitrified than highly silicated glass. Glass is probably an indefinite mixture of definite silicates. Glass containing small quantities of ferrous oxide and sodic sulphate, when exposed for some time to direct sunlight, becomes slightly yellow from oxidation of the ferrous oxide to ferric, with accompanying reduction of sodic sulphate to sulphide; a dull-red heat re-establishes the former state of equilibrium, and the glass becomes colourless; This change may be alternated any number of times; a temperature below that of annealing will not decolorise the yellow glass. It has been shown in a former memoir that carbon, silicium, boron, even hydrogen, will, by reducing the sodic sulphate generally present in glass, produce a yellow colour. On the other hand, glass containing ferrous oxide and coloured yellow at high temperatures by reduction of sulphates or direct addition of sulphides, remains coloured in annealing, because the iron is not in a condition to oxidise the sulphide to sulphate. Faraday in 1824 observed the coloration by sunlight of glass containing manganese. This phenomenon occurs whenever ferric and manganous oxides are in presence in glass; annealing, by causing a return to the iron of the oxygen transferred by it, under the sun's influence, to the manganese, destroys the amethystine colour. Yet, again, a sample of glass which would become violet by exposure to sunlight also becomes coloured if taken from the furnace and suddenly cooled, or if the annealing be omitted. Is there, then, a temperature intermediate between that of fusion and that of annealing which can produce the same effects on the glass as would be produced by sunlight?—(*Ann. Chim. Phys.*, S. 4, x. 184.)

Ammonia, Determination of.—Prof. A. Vogel. Determinations of ammonia in soils, &c., by alkalies proper, lime, or baryta, are generally too high, from the decomposition of nitrogenised compounds other than ammoniacal. Boussingault showed that freshly burnt magnesia exercised no such injurious power. To reduce this observation to practice, the substance to be examined, mixed with freshly ignited magnesia, is placed, accompanied by a known quantity of sulphuric acid, under an air-tight glass cover. The excess of acid remaining after several days' repose may be determined in the usual way. —(*N. Repert. Pharm.*, xv. 489.)

Ketones Compound (C = 6, O = 8). — G. Wischin. Phtalic chloride dissolved in benzol reacts with zincethyl to form phenylene-diethyl-acetone

$$\left.\begin{matrix}(C_{12}H_4)'' \\ (C_4H_5)_2\end{matrix}\right\}\left[\begin{matrix}C_2O_2 \\ C_2O_2\end{matrix}\right]$$

which crystallises from ether and melts at 52°. Succinic chloride gives in like manner ethylene-diethyl-acetone, a liquid of nasty odour, heavier than water, decomposing on heating, and having the composition

$$\left.\begin{matrix}(C_4H_4)'' \\ (C_4H_5)_2\end{matrix}\right\}\left[\begin{matrix}C_2O_2 \\ C_2O_2\end{matrix}\right]$$

Both are indifferent bodies. Experiments are being made to convert them into the corresponding alcohols.—(*Zeitschr. Chem.*, N.F., iii. 46.)

A New Thallium Mineral.—We hear that a selenide of copper, silver, and thallium has been found in Norway and analysed by M. Nordenskiörd. It contains 17 per cent. of thallium.

Medlock's Patent for Red and Purple Dyes.—We learn from the Commissioners of Patents' *Journal* that this patent, No. 126, dated January 18, 1860, has become void by reason of the non-payment of the additional stamp duty of 100*l.* before the expiration of the seventh year from date.

MISCELLANEOUS.

Sanitary Reform League. — We learn that a Sanitary Reform League has been established, for the purpose of bringing the force of public opinion, and, if need be, the power of the State, to bear upon the local authorities throughout the Kingdom; and further, if found necessary, of endeavouring to induce the Legislature to render more stringent the existing enactments relating to public health. The League already numbers among its members many gentlemen in London, Manchester, Liverpool, Leeds, and other towns. It is intended shortly to hold a conference in London, at which several eminent scientific men and members of Parliament, including some who have been active in framing or promoting sanitary legislation, have promised their attendance, to determine in what manner the objects of the League can be most efficiently attained.

Extract of Meat.—The food sub-committee of the Society of Arts are doing a very valuable service to the nation at large by their investigations which are now being instituted, and the evidence of Dr. Thudichum is not only interesting, but instructive, from the soundness of chemical knowledge displayed by it. Since the question is even now being discussed, before giving an abstract of the valuable evidence we have alluded to, we should like to ask some questions upon matters that have at present escaped due attention. If good beef-tea and extract of meat have such small nutritive power, containing, as they do, the creatine and salts, is it not probable, as has been before repeatedly asked, that they may possess the property, like tea and coffee, of diminishing the waste of the tissues? Does Dr. Thudichum know of any accurate determinations of the quantities of urea secreted by a patient with a diet of beef-tea, when suffering from diseases where the waste is in such great excess to the produce; and has not the question of prevention of waste much to do with that of nutritive food generally? An eminent Physician (Dr. Tanner) is our authority for the following:—"It has been proved that dogs die slowly if fed upon bread and gelatine alone, but when greatly reduced by this diet they soon regain flesh and strength if two ounces of meat-tea be daily added to it." We suppose that here a carnivorous animal is fed by gluten and starch, and waste is prevented by the chemical bases contained in the meat extract. Another thing that we should like to have had mentioned is the value of oatmeal as a substitute, in great part, for meat. It certainly is the main part of the food of one of the most vigorous people in the world. Perhaps oatmeal and extract of beef—if the latter be procured in sufficient quantity—would be one of the cheapest nutritious diets available for the lower classes, and an education in cookery would hardly be an essential for its preparation. Mr. Philpot, as it will be seen, who was in the habit of melting down 1000 to 1500 sheep daily in Australia, said that he had tried in vain to discover any process by which meat could be preserved except as an extract, as by Liebig's method. It is only rational to suppose, too, that the Extract of Meat Company would be enabled very greatly to reduce the price, if the demand were once established for a larger supply. We may mention that Professor Gamgee's method for the preservation of meat, mentioned in the Chemical News of March 15, 1867, will be submitted to a most rigorous trial. Dr. Thudichum's evidence is an epitome of the chemistry of meat, and the note that we append contains nearly the whole known by chemists about the matter. The object of the question first put to Dr. Thudichum was to ascertain whether it would be justifiable for the committee to recommend to the Government or any other public body the institution of experiments to show whether these preserved meats could become an entire or partial article of diet. At a former meeting the following had been considered:—Raw meat from South America preserved by Dr. Morgan's process; same by the paraffin method of Professor Redwood; Dr. Hassall's flour of meat—none of which were entirely approved of as substitutes for meat; and, lastly, Baron Liebig's extract of meat, the merits of which then called for examination. In reply to inquiries, Dr. Thudichum remarked—"Extract of meat lacks the essential properties of nutriment. There is a prevalent, but erroneous, opinion that extracts of meat, particularly that prepared on Dr. Liebig's plan, are nutritious. Tea and coffee will not nourish a man, but both tea and coffee are strong stimulants of the nerves of the heart and of the brain, and it is likely, I think, that the extracts of meat contain a substance which is somewhat similar in its effects to these stimulants. That is the view, I believe, that Liebig himself takes of his extract. If the committee desire to know whether I should recommend them to have experiments made upon the extract of meat of Liebig, I must answer that I do not see that any experiments are necessary unless they wish to open the entire question—What is the sense of our drinking beef-tea or drinking broth? There is so little nutriment (in it) that if you dissolve a teaspoonful of the extract in a cup of water and drink it, you will not receive so much nutriment as you would derive from a single mouthful of meat. Beef-tea seems to have an important effect, but the effect is not in the sense of nutriment; it is due to the specific effects of certain ingredients, especially creatine, the action of which in some degree resembles that of theobromine. Again, in beef-tea are potassium salts, which the body requires for the production of muscular power; potash is as essential an element in the chemistry of muscles as in that of the blood. Then, again, there are contained in beef-tea certain acids, of which lactic acid is one, and inosic acid another. If there is an absence of flavour in any kind of meat, lactic acid, if mixed with the gravy during preparation, acts as a substitute, and produces a relishing flavour, the fine flavour of meat; the osmazome which provokes appetite is due in part to the action of this lactic acid. We have to rely on these principles for an explanation of the efficiency of beef-tea, creatine, and creatinine, paralactic acid, inosic acid, inosite, and potassium salts—which are essential and which not, we cannot at present say. Too strong a solution of extract of meat is as bad as too strong tea or coffee." In answer to the chairman (Right Hon. H. A. Bruce, M.P.)—"Salt meat being an imperfect food, may I ask you whether this extract of meat would form a complement to that?"—Dr. Thudichum says: "I do not think so, because salt meat has been deprived of a certain amount of albumen. However, the loss of nutritious value from salting meat is not very great on the whole." As regards the nutritive qualities in meat itself which the extract does not contain, we find the following list of substances in fresh meat:—First, albumen; then syntonine. When we mince meat and extract the albumen by means of water, there remains this syntonine undissolved; but when mixed with dilute acids it becomes a thin jelly, and is afterwards dissolved. Then myochrome, the colouring matter contained in the muscles—this is chemically identical with the colouring matter contained in the blood. The use of this latter is to take up oxygen, and so oxidise the noxious products of the spontaneous decay of albumen, giving out carbonic acid. If the meat were shut up close after being killed, it would become putrefied in a few hours. This myochrome is a compound body containing a quantity of iron; it is dissolved with the albumen, and precipitated with it during boiling. Lastly, very little gelatine as well. Then the constituents as before mentioned of beef-tea, with a brown syrupy matter which is not more definable at present. Inosite is a kind of sugar met with in French beans, also contained in muscle and in beef-tea. An occasional product is animal dextrine, or hepatin, or glycogenic

substance from the liver. Sometimes in working half a hundredweight of meat the chemist may get a pound of this matter; at others he may not obtain a trace. When beef-tea is made, the albumen and myochrome of the meat are made insoluble by boiling; the syntonine also is undissolved. After straining there is nothing left in beef-tea but inosite, creatine, creatinine, lactic and inosic acids, potassium salts, brown syrupy matter, and occasionally glycogen; but the latter would probably be absent from the extract as prepared by Liebig's Company. Of the from 7 to 10 per cent. of soluble solid matter, 4 to 4½ become again insoluble by boiling, so that it is not far wrong to say that only from 3 to 5½ out of 25, or from $\frac{1}{5}$th to $\frac{1}{8}$th of the whole of the solid constituents of meat pass into extract or beef-tea. From $\frac{4}{5}$ths to $\frac{7}{8}$ths of the solids are rejected. This concludes the first part of Dr. Thudichum's evidence, and the reader will see that in the above answer to the question, "What nutritive qualities are there in meat itself which the extract (*i.e.*, Liebig's extract) does not contain?" the extract is taken as being identical with beef-tea as ordinarily prepared, with the assumption of sundry boilings, &c. The whole answer does not turn, as it should do, upon what is there in meat not in the extract of meat, but what substances there are not in badly prepared beef-tea that are found in good meat.

Chemical Dreams.—At the February meeting of the Massachusetts Institute of Technology, M. Fleury, of New York, explained the patented process of M. René Cupper, of Paris, for extracting iodine from sea water, which consists in the use of a new precipitating liquid composed of sulphate of copper, sulphate of the protoxide of iron, tartaric acid, and tartrate of ammonia, of which a mixture of only three pounds and a quarter—and which are afterwards nearly all recovered—precipitate one pound of iodine in the state of iodotartrate of protoxide of copper from 25,000 lbs. of sea water at a cost of about $1·50 per pound. He stated the present yearly importation (none being manufactured in America) as 120,000 pounds, at a price varying between $5·50 and $6 per pound. M. Fleury also gave a description of the properties of sulphide of silicium, and its preparation by the action of sulphur and carbon on quartz, or flint. He explained the manufacture of a pure hydrate of silica, a neutral solution of flint or opal in water, resulting from the decomposition of the sulphide of silicium. M. Fleury remarked that gold quartz could cheaply be brought from Nova Scotia to Boston, converted into sulphide of silicium, dissolved in water, and all the gold precipitated by specific gravity and forcing of the suspended particles through mercury; that the liquid (the value of which would more than pay for the expense of extracting the gold) mixed with other cheap materials of a proper consistency can, when poured into moulds, without application of fire or any heat whatever, form excellent snow-white flint marble statuary, tombstones, ornaments, and building-stones, hard enough to resist all the influences of the weather better than natural marble. M. Fleury remarked further that the cost of this flint-marble statuary, &c., is less than one-third of that of cut or chiselled marble.—*Scientific American.*

On the Economical Preparation of Sulphate of Magnesia.—M. Mirns prepares sulphate of magnesia from the residues of the manufacture of carbonic acid from magnesite and sulphuric acid. Those residues containing iron and lead (from the sulphuric acid) are set aside. The residues ought not to be acid; thus it is convenient to work with an excess of magnesia. If there is iron, add a little lime; if there is lead, a little sulphide of calcium obtained by igniting plaster of Paris with carbon. Do not filter, but decant, after having sufficiently diluted it to avoid crystallisation; after which, evaporate till the thermometer shows a temperature of 104° C. The liquid now solidifies on cooling. Then run it into a wooden vessel, and agitate it from time to time, so as to obtain small crystals. The small amount of mother liquor is submitted to a new concentration.—*Arch. der Pharm.* cxxvii. p. 195.

Meetings for the Week.

Monday, April 1.

Royal Institution, 2 p.m. General Monthly Meeting.
Medical Society, 8 p.m.

Tuesday, April 2.

Royal Institution, 3 p.m. Rev. G. Henslow "*On Botany.*"
Pathological Society, 8 p.m.
Geologists' Association, 8 p.m.

Wednesday, April 3.

Society of Arts, 8 p.m.
Geological Society, 8 p.m.
Pharmaceutical Society, 8 p.m.
Obstetrical Society, 8 p.m.

Thursday, April 4.

Royal Institution, 3 p.m. W. Pengelly, Esq., "*On the Antiquity of Man.*"
Royal Society, 8½ p.m.
Chemical Society, 8 p.m.

Friday, April 5.

Royal Institution, 8 p.m. W. Pengelly, Esq., "*St. Michael's Mount, Cornwall.*"

Saturday, April 6.

Royal Institution, 3 p.m. W. Pengelly, Esq., "*On the Antiquity of Man.*"

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. 0d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

G. L.—Received with thanks.

J. Knight.—The Millo Petroleum Gas-lamp is made by Messrs. Leplay and Noël, 14, Rue Belzance, Paris. A description of it was given in our number for January 11, page 16 of this volume.

M. J. S.—The topaz is destroyed by heat. Intense ignition drives off all the fluorine in the state of fluoride of silicium, and leaves silicate of alumina.

Student, R.C.C.—Yttria is contained in some specimens of cerite, but not in all. A friend of ours has worked up some hundredweights of cerite with the object (*inter alia*) of preparing the yttria from it, and did not find a trace.

Teroxide of Antimony.—A correspondent has seven or eight cwt. of teroxide of antimony, chemically pure, with the exception of a trace of free chlorine. He wishes to dispose of it, and will be glad to know what price can be offered for the whole or part of it.

Querist.—Palladium is very expensive and rare at the present time. If you have a stock of it, you need be in no want of a subject for original investigation. The remarkable behaviour of the solid metal towards gases is well worth all the attention you can bestow upon it. The organic compounds of palladium have also been very little studied.

Japhet Farquerson.—Bellini has given the best directions for treatment in cases of phosphorus poisoning. He relies upon the administration of ether to arrest the combustion of phosphorus in the stomach, and makes the patient inhale air containing a little ether vapour. This treatment he supplements with emetics and purgatives, and administers mucilaginous liquids and magnesia to neutralise the phosphoric acid. M. Barreswil, commenting on this, says that he prefers spirits of turpentine to ether. The chemical portion of this treatment is, no doubt, excellent. Whether it would answer in a medical point of view is more than we can say. Chemists, when they turn medical men, are too apt to consider the stomach as a test-tube, and expect chemical reactions to go on in it just as neatly as they do at a lecture table.

THE CHEMICAL SOCIETY.

In our report in another column of the anniversary meeting of this Society held on Saturday last, we give, as in duty bound, without comment, a simple report of the proceedings. We should, however, scarcely be doing our duty as faithful chroniclers of the proceedings of the Society were we to omit all reference to an under-current of excitement which has stirred the Fellows for some time past, and, but for the admirable tact and forbearance of its officers, would have culminated in serious injury to the Chemical Society.

It is known to many of our readers that the proceedings at the anniversary meeting are mostly of a formal character, no papers being read, and, possibly owing to this cause, it is, as a rule, very scantily attended. The principal business is to elect the officers and Council for the ensuing year, and, to facilitate this object, the laws provide that printed lists of those members whom the Council recommend for election should be previously sent to every Fellow of the Society, who, should he think that he can suggest any better representatives than those proposed by the Council, may substitute other names on his voting paper, and hand it to the scrutators whose duty it is to report which candidates have received the greatest number of votes. The chairman then announces the result to the meeting, and the election is complete. Effective provision is thus made for giving to each Fellow of the Society a free voice in the election of representatives, and members are of course perfectly justified in discreetly exercising this right whenever they think fit. In practice, however, in this, as in all other scientific societies where similar regulations exist, the members are satisfied with possessing this right, and seldom or never exercise it. But few instances are on record in which the list proposed by the Council of a learned society has not been accepted unanimously.

Most Fellows of the Chemical Society will hear with considerable surprise that the proposed list of officers and Council which they received a few weeks ago has met with an organised opposition. A young gentleman of little more than a year's standing in the Society, whose claims for distinction over any of the 500 other Fellows are absolutely *nil*, has had the presumption to set his own crude conception of what is best for the interests of the Society in opposition to the sagacity and matured experience of the Council. In total ignorance of the principles which guide the selection of Council and officers, our revolutionary young friend ventured to nominate another President, another Secretary, another Treasurer, and sundry other members of Council. This is sufficiently startling; but this is not all. He has not scrupled to go about soliciting votes to place upon the Council——himself! Need we stop to characterise conduct like this? However, the preposterous cabal signally failed. But for the proverbial impossibility of keeping a plot secret, he might, with the aid of a handful of supporters, in a scant general meeting, have snatched a short-lived triumph. As it happened, however, the friends of the Society mustered in force, and, by a majority of nearly four to one, decisively crushed the unwarrantable opposition.

Now, we do not wish to stop the reasonable exercise of the right of members to question the nominations of the Council. Indeed, we have noticed several cases in which that right might have been very advantageously enforced; but this reckless, unjustifiable, wholesale substitution of names passes the bounds of legitimate interference. We appeal to the good sense of the few who were misled on this occasion to compare the existing list with the counter-list which was rejected, and to ask themselves seriously whether it would have been an improvement. Where it is proposed simply to replace one eminent man by another equally eminent, no great harm would be done either way; but for the members to be asked to remove from the Council men who have grown grey in the service of science, whose words are listened to with attention, whose papers are read with interest wherever civilisation has penetrated, and to replace them, among others, by one who, beyond a very limited circle of young admirers, carries no weight whatever, is a proposition unfit for serious discussion.

For the future, care must be taken to prevent the Society becoming unawares, even temporarily, at the mercy of a small minority. In the present instance, if entrapped into a defeat in the meeting-room, by the efforts of a numerical majority, but constituting really an insignificant fraction of the Society at large, it is not improbable that the Council would have resigned in a body, and thus jeopardised the very existence of the Society.

An alteration in the customary method of voting would obviate such difficulties in future. All Fellows of the Society possess a voice in the election of their Council and officers, but at present this responsible duty is exercised only by the few London members who will take the trouble to attend these anniversary meetings. Cancel the rule which makes personal presentation of the voting papers necessary, and allow them, properly signed, to be sent up to the Secretary by post, or handed in by friends, and the difficulty would vanish. The elections then, instead of being liable to fall under the control of a small clique, would be carried out by the whole body of Fellows; and the governing body, in that case, would more truly represent the wishes of the Chemical Society of England than is possible under any system which necessitates personal voting.

Viennese Meerschaum.—The product known as Viennese meerschaum is prepared by mixing 100 parts of silicate of sodium at 35° with 60 parts of carbonate of magnesium and 80 parts of the native meerschaum or pure alumina. This mixture is then pulverised with the greatest care, and passed through a sieve of very fine silk or horsehair; add water, and boil it for ten minutes; then pour the whole into moulds, placed so that the water may separate easily.—*M. Holdmann.*

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Classification of Native Silicates, by* WILLIAM ODLING, *M.B., F.R.S.*

THE silicates of different metals constitute, both in number of species and extent of distribution, by far the most abundant class of native minerals. They are found in well-defined crystals, and in the crystalloidal, fibrous, and amorphous states, both as isolated compounds, and as variously mixed constituents of different rocks. Granite and gneiss, for example, consist chiefly of quartz or silica, felspar, and mica; syenite of quartz, felspar, and hornblende; porphyry and trachyte of felspar; and basalt of felspar with augite and labradore. Hornblende also occurs, intimately mixed with felspar or albite, in the form of greenstone; chlorite in different varieties of slate; and serpentine in serpentine rock.

The determination of the formulæ of many native silicates is a matter of considerable difficulty, on account more especially (α) of the several different classes of silicates which undoubtedly exist; (β) of the variable isomorphous replacement of different metals by one another in the same silicate; (γ) of the unknown function of fluorine, chlorine, boric oxide, and alumina in certain mixed silicates; (δ) of the unknown function of hydrogen on certain hydrated silicates; (ϵ) of the occurrence even in well-crystallised silicates of accidental impurities; (ζ) and, lastly, on account of the great complexity of many native silicates, and consequent unavoidable inaccuracy in their analysis.

(α) The great majority of native silicates, probably four-fifths of the entire number, are divisible into four principal classes, known as sesqui-, meta-, para-, and ortho-silicates, which may be represented respectively by the following general formulæ. A few anhydro-silicates, containing an excess of silica beyond that found in the sesqui-silicates, are also known; while in one or two aluminous silicates, the proportion of silica is less even than in the ortho-silicates—

Sesqui-silicates	$x(M_2Si_3O_8)$	or	$x(2MO.3SiO_2)$
Meta-silicates	$y(M\ Si\ O_3)$	,,	$y(\ MO.\ SiO_2)$
Ortho-silicates	$z(M_2Si\ O_4)$	,,	$z(2MO.\ SiO_2)$
Para-silicates	$z(M_2Si\ O_4)\ .\ y\ (MSiO_3)$		

The combinations of most frequent occurrence among members of the intermediate class of para-silicates are the three following, and especially the second of them, but others are occasionally met with—

$2M_2SiO_4.1MSiO_3$ or $5\ MO.3SiO_2$
$1M_2SiO_4.1MSiO_3$,, $4\frac{1}{2}MO.3SiO_2$ or $3MO.2SiO_2$
$1M_2SiO_4.2MSiO_3$,, $4\ MO.3SiO_2$

It is observable that the ratio of the oxygen of the base to the oxygen of the silica is as 1 to 1, or 2 to 2, in ortho-silicates; most generally as 3 to 4, but variable between 2 to 2, and 1 to 2 in para-silicates; as 1 to 2 in meta-silicates; and as 1 to 3 in anhydro-sesquisilicates. Accordingly it is found convenient in many cases, for the sake of comparison, to express the composition, more particularly of complex silicates, by formulæ which render these oxygen ratios most easily apparent, as in the following examples—

$\frac{1}{4}$ Ortho-silicate	$Ca_3Al_2O_6.Si_3O_6$	Garnet.
$\frac{3}{4}$ Para-silicate	$Ca_6Al_2O_9.Si_6O_{12}$	Humboltite.
$\frac{1}{2}$ Meta-silicate	$K_2\ Al_2O_4.Si_4O_8$	Leucite.
$\frac{1}{3}$ Sesqui-silicate	$K_2\ Al_2O_4.Si_6O_{12}$	Felspar.

* Dr. Odling has kindly given us permission to publish occasional chapters from the forthcoming second part of his "Manual of Chemistry."—ED. C. N.

(β) Although many native silicates exhibit a tolerable constancy of composition, other well-defined species are observed to enjoy a wide range of variation, through the isomorphous substitution in them of one constituent for another. Thus, the monad alkali-metals lithium, sodium, and potassium—occasionally all three, very frequently any two of them—are found replacing each other in all proportions; while among diad metals, magnesium and calcium seldom occur in the form of silicates, as entirely separate compounds, and, in the same mineral species, are met with in every variety of isomorphous admixture. Both—but more especially calcium—are in certain silicates replaceable to a greater or less extent by alkali-metal; while both—but more especially magnesium—are, in most silicates, habitually replaced by some iron and manganese, in the diad forms of ferrosum and manganosum. In many aluminous silicates, again, a portion of the triad or pseudo-triad aluminium is replaced by iron, with or without some chrome and manganese, in the forms of ferricum, chromicum, and manganicum.

In writing the formulæ of silicates, complex by reason of the greater or less mutual substitution of isomorphous metals in them, it is customary to express only their leading constituents. Thus, a variety of uniaxial mica is expressible as a parasilicate by the formula $Mg_2Al_2O_3.Si_3O_6$, or $Mg_2Al_2Si_3O_{11}$. But in reality a variable proportion of the magnesium is found to be replaced by iron, manganese, calcium, and potassium, and a variable proportion of the aluminium by ferricum, so that the full formula of the mineral would be—

$$(Mg\text{-}Fe\text{-}Mn\text{-}Ca\text{-}K)''_2\,(Al\text{-}Ffe)'''_2\,O_5\,.\,Si_3O_6.$$

Moreover, although in many complex silicates the ratio of diad to triad metal is most constant and characteristic, as in the garnets, it seems to be established beyond all question, that in other and even closely allied species, as the idocrases, the ratio is very variable, ferrosum and the diads generally replacing ferricum and the triads isomorphously, in the proportion of $_3FeO$ to $FfeO_3$.

The well-defined mineral epidote, for instance, is usually formulated thus—$Ca_3Al_4O_9.Si_4O_8$, or, more fully, thus—

$$(Ca\text{-}Mg\text{-}Fe\text{-}Mn)''_3\,(Al\text{-}Ffe\text{-}Mm)'''_4\,O_9\,.\,Si_4O_8.$$

But Laurent showed, by an examination of the actual analyses of fifteen different varieties of epidote from different localities, that the average experimental ratio of the oxygen of the bases to the oxygen of the silica was as 99·7 to 100, and the extreme range of ratio between 95·5 to 100, and 103 to 100. On the other hand, the ratio of the oxygen of the triad bases to the oxygen of the silica ranged between 69 and 51 to 100, with a mean of 64·2 to 100, while the ratio of the oxygen of the diad bases to the oxygen of the silica ranged between 30·2 and 45·8 to 100, with a mean of 35·5 to 100. Epidote, accordingly, proves to be a complex ortho-silicate, expressible by the formula $(Ca\text{-}Al)O_2.SiO_2$, or $(Ca\text{-}Al)SiO_4$.† In the micas, again, while the ratio of the oxygen of the united bases to the oxygen of the silica varies only between $\frac{11}{12}$ths and $\frac{12}{12}$ths, the ratio of the oxygen of the joint monad and diad bases to the oxygen of the triad bases varies between $\frac{1}{0}$th and $\frac{1}{0}$ths in different specimens. By having regard to this partial mutual replacement of diads and triads, many other silicates, usually expressed by very complex formulæ and oxygen ratios, are reducible to some one or other comparatively simple type.

† The mean result of all the analyses is represented by the formula $Ca_5Al_6O_{14}.Si_7O_{14}$.

(γ) Fluorine, replaceable wholly or partly in certain minerals by chlorine, is met with as a constituent of several native phosphates, silicates, borates, and aluminates. It would seem that in some cases the halogen acts simply as a salt-radical, supplying the place of a deficiency of oxygenised radical. Thus, in wagnerite, two atoms of diad magnesium are associated with one atom of triad oxiphosphion, and with one atom of monad fluorine, to form a double salt of the ordinary character, expressible by the formula $Mg''_2|PO_4)'''F$.‡ Again, in apatite $Ca''_5|PO_4)'''_3F$, and polymorphite $Pb''_5|PO_4)'''_3F$, the halogen would seem to fulfil a similar function in balancing the excess of base-equivalent, although it has not escaped notice that in apatite, at any rate, the amount of halogen is liable to much variation, becoming in some specimens almost infinitesimal.

But it is well known that the halogens, more especially fluorine, can form saline compounds, differing only from ordinary salts in the substitution of fluorine for oxygen. Thus we have the fluoboride KBF_4, corresponding to borate of potassium KBO_2; fluosilicide of calcium $CaSiF_6$, corresponding to wollastonite $CaSiO_3$, &c. Now it would appear that, in most halogenous silicates and borates, the constituent halogen does not compensate for an atomic deficiency of oxygenised radical, but replaces an indefinite proportion of oxygen in the radical isomorphously. This is well seen in boracite, some specimens of which are quite free from halogen, and referrible to the formula MgB_2O_4. But in many boracites, about $\frac{1}{16}$th part of the oxygen is substituted by chlorine, so that the formula has to be written $MgB_2(OCl)''_4$, or more fully $Mg_4B_8(O_{15}Cl_2)$.§ Again, in topaz, Al_2SiO_5, a quantity of the oxygen varying from $\frac{1}{8}$th to $\frac{1}{6}$th part is found to be replaced by fluorine, so that the formula of the compound has to be written $Al_2Si(OF)''_5$, or more fully, though not so accurately, $Al_6Si_3(O_{13}F_4)$. It is noticeable that neither in boracite nor topaz does the halogen replace an entire proportion of oxygen, in what may be considered as a unit of the mineral; while in most other halogenous minerals, as in the micas, hornblendes, and tourmalines, the replacement is still more limited and irregular. The determination of the function fulfilled by fluorine or chlorine in any particular silicate is a question for the judgment, but in those cases where it is believed to replace an indefinite quantity of oxygen isomorphously, its expression may be omitted from the usual formula of the silicate, just as the expression of the secondary metals, substituted isomorphously to a greater or less extent for the principal metals of other silicates, is omitted from their respective formulæ.

(To be continued.)

On the Application of the Blowpipe to the Quantitative Determination or Assay of certain Metals, by David Forbes, *F.R.S., &c.**

(*Continued from page* 40.)

Silver Assay.—The blowpipe assay of silver ores was first described in 1827 by Harkort,† and subsequently considerably improved by Plattner. This assay process is in all cases based upon the reduction to a metallic state of all the silver contained in the compound in question along with more or less metallic lead, which latter metal, when not already present in sufficient quantity in the substance itself under examination, is added in the state of granulated lead to the assay previous to its reduction. The globule of silver-lead thus obtained, if soft and free from such elements as would interfere with its treatment upon the cupel, may then be at once cupelled before the blowpipe until the pure silver alone remains upon the bone-ash surface of the cupel; but if not, it is previously submitted to a scorifying or oxidating treatment upon charcoal until all such substances are either slagged off or volatilised, and the resulting silver-lead globule cupelled as before.

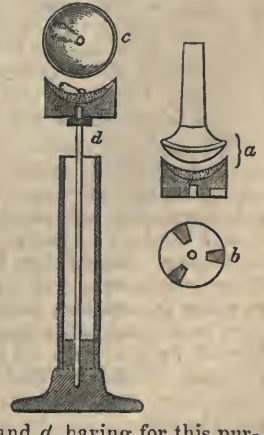
As, therefore, the final operation in all silver assays is invariably that of cupelling the silver-lead alloy obtained from the previous reduction of the substance, effected by methods differing according to the nature of the argentiferous ore or compound under examination, it is here considered advisable to introduce the description of the silver assay by an explanation of this process.

In the ordinary process of cupellation in the muffle, bone ash or other cupels are employed of a size large enough to absorb the whole of the litharge produced from the oxidation of the lead in the assay.

This, however, should not be the case when using the blowpipe; for as the heating powers of that instrument are limited, it is found in practice much better to accomplish this result by two distinct operations—the first being a concentration of the silver-lead in which the greater part of the lead is converted by oxidation into litharge remaining upon, but not, or only very slightly, absorbed by, the bone-ash cupel; and the second in cupelling the small concentrated metallic bead so obtained upon a fresh cupel until the remaining lead is totally absorbed by the cupel and the silver left behind in a pure state. By this means a much larger weight of the silver-lead alloy can be submitted to assay, and, for reasons hereafter to be explained, much more exact results are obtained than would be the case when the cupellation is conducted at one operation in the ordinary manner.

The apparatus used by the author for these operations are shown to a scale of one-half their real size in the woodcuts Fig. 5 (*a* to *d*).

Fig. 5.



In Fig. 5 *a* is represented in section a small cylindrical mould of iron, seven-tenths of an inch in diameter, and about four-tenths high, in which is turned a cup-shaped nearly hemispherical depression two-tenths of an inch deep in centre, the inner surface of which is left rough, or marked with minute ridges and furrows for the purpose of enabling it to retain more firmly the bone-ash lining, which is stamped into it by means of the polished bolt also shown in the figure. This mould rests upon the stand *d*, having for this purpose a small central socket in its base, into which the central pivot of the stand enters. This socket is seen in the ground plan *b* of the base of the mould, which shows likewise three small grooves or slots made in same to enable a steady hold to be taken of it, when hot, by the forceps. The stand itself is composed of a small turned ivory or wood base, fixed into a short piece of

‡ In such expressions as this, the reader will recognise an adoption of Mr. Graham's antithetic formulæ.

§ Usually written $3MgO.4B_2O_3.MgCl_2$.

* Communicated by the author.

† *Die Probirkunst mit dem Lothröhre*, Freiberg, 1827, I. Heft (all published).

strong glass tubing, which, from its non-conducting powers, serves as an excellent handle. In centre of the base a slight iron rod rising above the level of the glass outer tube serves as a support for the cupel mould, into the socket in the base of which it enters.

Bone ash is best prepared by burning bones which previously had been boiled several times, so as to extract all animal matter. The best bone ash is made from the core-bone of the horns of cattle well boiled out and burned. The ash from this is more uniform than from the other bones, which have in general a very compact enamel-like exterior surface, whilst the interior is of a much softer nature.

Concentration of the Silver-lead. — A cupel is prepared by filling the above-described cupel mould with bone-ash powder not finer than will pass through a sieve containing from forty to fifty holes in the linear inch, and should be well dried and kept in an airtight bottle, and the whole pressed down with the bolt, using a few taps of the hammer. It is then heated strongly in the oxidating blowpipe flame in order to drive off any hygroscopic moisture. The bone-ash surface of the cupel, after heating, should be smooth, and present no cracks; if the reverse, these may be removed by using the bolt again and reheating.‡ The silver-lead, beaten on the anvil into the form of a cube, is placed gently upon the surface of the bone ash, and, directing a pretty strong oxidating flame on to its surface, it is fused, and quickly attains a bright metallic appearance, and commences to oxidise with a rapid rotatory movement. (Occasionally, when the assay is large, and much copper or nickel present, the globule may, under this operation, cover itself with a crust of oxide of lead or solidify; in such cases direct the blue point of a strong flame steadily on to one spot on the surface of the lead globule until it commences oxidating and rotating. In some cases where much nickel is present, an infusible scale, impeding or even preventing this action, may form, but will disappear on adding more lead—say from three to six grains, according to the thickness of this scale or crust.) When this occurs the cupel is slightly inclined from the lamp, and a fine blue point obtained by placing the blowpipe nozzle deeper into the flame, and the lamp is directed at about an angle of 30° on to the globule—not, however, so near as to touch it with the blue point, but only with the outer flame, so moderating it as to keep the assay at a gentle red heat, and not allowing the rotation to become too violent.

This oxidating fusion should be carried on at the lowest temperature sufficient to keep up the rotatory movement, and to prevent a crust of litharge accumulating upon the surface of the globule, but still sufficiently high to hinder the metallic globule from solidifying. Should this, however, happen, a stronger flame must be employed for a moment until the metal is again in rotation; such interruptions should, however, be avoided. The proper temperature can only be learned by practice, a too high temperature is still more injurious, causing the lead to volatilise, and, if rich in silver, carry some of that metal mechanically along with it. The litharge also, instead of remaining on the cupel would be absorbed by the bone ash, and as the surface of the metallic globule is covered by a too thin coating of fused litharge, some silver may be absorbed along with the litharge. In this operation, in order to avoid loss of silver, the fused globule should be always kept in contact with the melted litharge.

By the above treatment, the air has free access to the assay, and the oxidation of the lead and associated foreign metals goes on rapidly. The surface of the melted globule, when poor in silver, shows a brilliant play of iridescent colours, which does not take place when very rich in silver. The litharge is driven to the edge of the globule, heaping itself up and solidifying behind and around it. When the globule becomes so hemmed in by the litharge as to present too small a surface for oxidation, the cupel is moved so as to be more horizontal (having been previously kept on an inclined position), thus causing the lead globule to slide by its own weight on one side, and expose a fresh surface to the oxidising action. When the lead is pure, the litharge formed has a reddish-yellow colour, but, if copper is present, is nearly black.

In concentrating silver-lead, it must be remembered that an alloy of lead and silver, if in the proportion of about 86 per cent. silver along with 14 per cent. lead, when cooled slowly in the litharge behaves in a manner analogous to the spitting of pure silver, throwing out a whitish-grey pulverulent excrescence rich in silver. For this reason, therefore, the concentration above described should be stopped when the globule is supposed to contain about six parts silver along with one part in weight of lead. In case, however, this limit should have been exceeded, it is advisable at once to push the concentration still further until the silver globule contains but very little lead. In practice with poor ores it is usual to concentrate the lead until the globule is reduced to the size of a small mustard seed, or in rich ores to some two or three times that size. Upon arriving at this point, the cupel is withdrawn very gradually from the flame, so that the cooling shall take place as slowly as possible until the globule has solidified in its envelope of litharge. If cooled too quickly, the litharge, contracting suddenly, would throw out the globule, or even cause it to spirt; in such case it should be touched by the point of the blue flame so as to fuse it to a round globule, which is cooled slowly, as before described. The globule is now reserved for the next operation, for which purpose it is, when quite cold, extracted from the litharge surrounding it.

(To be continued.)

‡ These precautions are very important, as the slightest trace of moisture in the substance of the bone ash would inevitably cause a spirting of the metal during the operation.

Analytical Notes on Cadmium, by Professor F. WÖHLER.

Separation of Cadmium from Zinc.—Add a considerable excess of tartaric acid to the solution containing these two metals. Then add solution of caustic soda until the reaction is decidedly alkaline, and after dilution with much water keep the solution in a state of ebullition for several hours. Only the cadmium is deposited. The zinc may be separated from the filtrate by sulphide of ammonium.

Separation of Cadmium from Copper.—Well wash the precipitated sulphides, and then dissolve them in hydrochloric acid, to which is added chlorate of potash. Precipitate the solution by an excess of potash, and dissolve the precipitate in hydrocyanic acid. This will form a solution of double cyanides, from which sulphuretted hydrogen precipitates the cadmium, but not the copper. Or the solution of the sulphides may be treated as in the case of cadmium and zinc, and the filtrate containing the copper oxidised with aqua regia and precipitated with caustic potash.

Copper and cadmium may also be separated by precipitating the former with sulphocyanide of potassium, after having first reduced it with sulphurous acid.

PHARMACY, TOXICOLOGY, &c.

The New Pharmacopœia (1867).

In a few weeks — we hope in time for the summer course at the various medical schools—will be published a work which, the *British Medical Journal* says, will be one of the best Pharmacopœias extant, yielding to none of the foreign ones. It will, of course, by the criticism that it meets with abroad, reflect indirectly upon the present state of the higher science of chemistry in England, and so we propose to give our readers an outline of the changes that have been made since the publication of the first national Pharmacopœia.

The book itself will be cheaper than the last edition was; we believe the price will be 6s., and a very large number of copies will be prepared, as it is expected that another edition will not be required for some time.

The preparation of the work has been attended with little cost when compared with the first British Pharmacopœia; and it is expected that, commercially, the result will be a gain to the Medical Council instead of a loss, as before.

The general arrangement of matter will make reference very easy. All the substances follow the alphabetical order of the Latin names, so the book looks like a dictionary. An index is given supplementary to this, so that if the Latin name be not known or forgotten the information is supplied by a reference to the English names and synonyms. This, our readers will at once see, is a radical change from the arrangement of the current edition, and it certainly gives a much more pleasing and concise appearance to the whole.

An addition of still greater value is a list of all the preparations in which the drug under discussion is contained, with the proportion shortly stated. This information previously was only to be obtained from the indices of Materia Medica manuals, or companions, &c., to the Pharmacopœia. In this way most of such handbooks will become superfluous.

Another encroachment upon what has before now been considered the special province of this class of books is the addition of the doses, "the quantities stated under this head being intended to represent average doses in ordinary cases for adults. The doses are not authoritatively enjoined by the Council, and the practitioner must rely on his own judgment and act upon his own responsibility in graduating the doses of any therapeutic agents which he may wish to administer to his patients."

This will be matter of self-congratulation to the student, who up to this date has had of course to work up the doses given by the examiner in a text-book or otherwise, as it is well known that opinions differ much on the point.

There are ninety-nine substances in this new edition not to be found in the previous one; these consist of things new and old, new drugs recommended by the party of progress, and pet remedies of men of the old school contained in the Pharmacopœias of the different colleges of the United Kingdom.

This, therefore, like so many other successful English institutions, is a compromise, and, indeed, a liberal spirit is required in this respect in the present state of medical science, however clear it may be that the tendency of scientific pharmacy and medicine is to a decrease, not an increase, in the number of remedies.

For example, if chemists show that oak-bark, elm-bark, catechu, &c., all and each derive their virtues from tannin, it would be thought that a mere statement of the fact would make some dozen drugs of this description at once obsolete. Further, when tannin is shown to be a glucoside, which glucoside breaks up in the human body into dextrine and gallic acid, the gallic acid being found as such in the urine, gallic acid would be supposed to supersede at once the use of tannin.

We are sorry that this rational progress should be interfered with by such an increase in the number of drugs. The Pharmacopœia does not sin so much by commission in this respect as by omission; when new substances are introduced at such a rate, room should be made for them in the manner we have indicated. Four substances found in the last edition are omitted in this new one—black catechu, cocculus, ointment of cocculus, rectified pyroxylic spirit.

They may be very well spared, and we hope that, now that the protecting wing of medicine is taken from the cocculus indicus, no excuse will remain for its importation, and its finally finding its way into beer to such a large and deleterious extent.

Two new classes of substances are now introduced for the first time, inhalations (prussic acid, chlorine, conia, creosote, iodine); glycerines (carbolic acid, gallic acid, tannic acid, starch, borax); while the essences are restored from the Dublin (anise and peppermint), and the vinegars (Spanish fly and squills) from the London Pharmacopœias respectively, omitted in the first British Pharmacopœia.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, April 3, 1867.

One of the greatest curiosities of the Universal Exposition, opened on Monday last, is the laboratory of the Imperial Commission, constructed quite near the entrance at the side of the Pont d'Jena. It is under the special direction of M. Grandeau, one of the organisers of Class 44 (*Produits Chimiques et Pharmaceutiques*), with the collaboration of MM. Sainte-Claire Deville, Debray, Troost, Captain Caron, Schloessing, &c. A portable gasometer, after the system of M. Jouanne, gives oxygen gas furnished by the apparatus of M. Tessié de Mothay for the Drummond or Carlevaris lamp, or for the oxyhydrogen lamp of M. Schloessing, of which M. Wiesnegg, No. 5, Place de la Sorbonne, makes at present excellent models. The Imperial Commission has decided that the laboratory shall be placed at the disposition of all the metallurgical chemists, &c., who may require to make experiments or assays. It is from this laboratory that will be procured for our lecture-hall the oxygen gas which is to serve for the supply of the magnesia lamp.

Mr. Sterry Hunt, who is at this moment in Paris, where he represents Canada at the Universal Exhibition of 1867, has informed us of a considerable progress that has taken place recently at Boston, U.S., in the heating of steam generators. In this new and curious method the coal is reduced to a very fine dust, and is blown or injected by a current of compressed air into the furnace, where it burns with a very intense flame. By this means nothing is lost, and the production of steam is much greater. It is astonishing that no one has thought of making use in this way of the immense quantities of coal-dust which are now annually wasted at the pit's mouth.

We return to the subject of the production of oxygen gas by the decomposition of sulphuric acid; and this reminds us principally that, in itself, and independently of

the essential perfections that it can receive, the process has come before the public in the form in which it had been applied formerly by MM. Peligot and H. Sainte-Claire Deville. One of these essential improvements, discovered and patented by M. Tessié de Mothay, consists of—1, decomposing sulphuric acid by making it fall, at a temperature of more than 1500° C., upon a thick layer of sulphate of alumina, which is decomposed at nearly the same temperature, and protects at the same time the metallic vessel in which the decomposition is effected; 2, to conduct the mixture of oxygen and sulphurous acid thus disengaged through carboys containing magnesia at the most favourable temperature for its combination with the sulphurous acid separated; or else by forming sulphite of soda, in which operation it is absorbed in such a manner that it can be despatched to any distance, and can serve, instead of pyrites, for the disengagement of sulphurous acid ready to be converted into sulphuric acid in the leaden chambers. The process thus put in practice of the preparation of oxygen by sulphuric acid, although theoretically inferior to that by the manganate of soda, becomes truly a branch of industrial art, and can be applied in various ways.

M. Z. Roussin has called our attention to a barefaced fraud practised for some time past on soaps with potash bases, called soft soaps, black soaps, green soaps, which are employed daily in the pharmaceutical and veterinary arts, and for domestic purposes. Out of sixteen samples of soft soaps procured at hazard at different shops in Paris, M. Roussin found 10, 20, and often 25 per cent. of fecula of inferior quality, not to be detected by simple inspection. The difference of price between the feculæ of bad quality and the soft soaps sufficiently explains the motive for this adulteration. The feculæ, in fact, are sold at 20 to 45 fr. the 100 kilogrammes, while the price of pure soft soaps is from 60 to 70 fr. In order to ascertain the presence of the fecula, all that is necessary is to press between the two glass discs of a microscope a little soft soap about the size of the head of a pin. Hundreds of amylaceous granules appear under the magnifying power, most of them being swollen. If it is required to know the proportion of fecula mixed with the soap, take 10 grammes of soap, and dissolve it cold in 30 or 40 cubic centimetres (3 or 4 centilitres) of alcohol of 85 per cent. The pure soap is dissolved, and the fecula is deposited. This, when dried, is in the state of a pulverulent mass, of a grey colour, that can be weighed, and which, boiled with water and brought into the state of starch, colours enormous quantities of water when a solution of iodine is added.

On the subject of the nodules possessed by the Comte de Douchet, which have the same composition as anthracite and the hardness of the diamond, and even greater, since they are able to scratch the latter, M. Charles Mène reminds us of the experiments he made upon an anthracite coal from Creuzet, the composition of which is—carbon 0·982, hydrogen 0·002, oxygen 0·004, ash 0·012. Heated to a high temperature and for a long time in a crucible in the middle of a coke furnace, this black diamond takes a metallic lustre, of a remarkable character, in pieces which have the sp gr. 1·637, and which scratch and cut the hardest glass. Since the presentation of these nodules to the Academy of Sciences, M. de Douchet has been informed by an English gentleman that he had seen similar specimens in Australia. We shall examine the products of that wealthy and industrial English colony, as shown in our Exhibition, and acquaint our readers with the result.

Cement.—Alum and plaster of Paris well mixed together with water, and used in the liquid state, will form a very useful cement. It will be found handy in the laboratory for many purposes. It forms a very hard composition, and for fixing the brasses, &c., on paraffin lamps nothing could be better.

THE INAUGURATION OF THE PARIS EXHIBITION OF 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

THE ceremony of the opening on Monday last was attended with the greatest success as regards weather and the punctuality of the imperial and royal personages, the officers of the commission, &c. Favoured by a brilliant sunshine, it took place in the presence of 100,000 persons in the building and park; the heights of Trocaders were also crowded with spectators.

The galleries of the Exhibition, for it can no longer be called a palace, do not present the wonderful and magic effect of the naves of the Crystal Palace at Hyde Park in 1851, and which now crowns the Sydenham hills; neither do they in any way resemble the Palais de l'Industrie in the Champs Elysées, and its annexes at the river side, which displayed a considerable area, yet deficient in *ensemble* and purpose; nor have they the shapeless and almost ridiculous outward form of the 1862 building at Kensington, redeemed, however, by the incontestably excellent interior arrangement. The galleries of 1867 present a new and original feature, and can be compared to no other building of the same nature; their appearance is monumental enough and worthy of containing the great industrial riches placed within its walls, and the arrangement described below is well adapted to their noble destination. The exterior has the form of an immense elliptical circus 490 metres long by 380 wide. It encloses 10 concentric galleries, ranged round a central garden containing about an acre and a quarter. These galleries are traversed by radiating alleys, of which those from north to south and from east to west form wide and extensive promenades. Each of the galleries is filled with products of a certain class. Thus we have—1. Works of art; 2. Materials and application of the liberal arts; 3. Furniture and other household objects; 4. Clothing and other personal objects; 5. Raw produce of manufacturing industries; 6. Apparatus and processes of the common arts; 7. Food, natural and preserved, and the processes of preparation; 8. Living products and specimens of horticulture.

The mode of distribution and of attribution of the circular galleries is very simple and ingenious. The outer circle (*machinery*) is 25 metres high by 35 wide, and is furnished with a broad middle platform about 20 ft. from the ground, from which all the machinery can be seen admirably. The building is to be ventilated by the system of M. Mondesir and Perigault's double fan, giving 700,000 cubic metres of air per hour.

The general masonry of the galleries and their foundations absorbed 50,000 cubic metres of materials; the framing used 13,500 tons of cast and wrought iron, and 53,000 square metres of thin boards for zinc roofing. It is almost incredible that this vast establishment was erected in about a year. M. Krantz, the now—and for ever—celebrated contractor of the Imperial Commission, was obliged, for the whole of this time, to design during the night what was to be built the following day. It is much to be regretted that heaps of irregular constructions, &c., completely hide the Exhibition building viewed from the Pont d'Jena, opposite the principal entrance; the buildings, also, for the hydraulic machines contribute not a little to this lamentable effect.

The ministers, the diplomatic corps, the members of the Household of their Imperial Majesties and Highnesses, the leading members of the Senate, the Legislative Assembly, and the Council of State took their places in the French gallery of the works of art; the persons invited by the Imperial Commission, the foreign commissioners, and the representatives of the Paris press filled the saloon of the exotic works of art. Our entrance card of invitation led us to the saloon No. 1 (paintings, sculp-

ture, and engraving of the States of the Church). At the entrance is a statue, nearly of full size, of Napoleon I., due to the chisel of the Milanese artist Vicenzo Valla, and bearing the following mournful inscription:—"*The last days of Napoleon the First:* depicted on the features are desolation and grief painfully startling."

While waiting for the *cortége*, we had an opportunity of admiring the meteorograph of the R. M. Secchi, Director of the Roman College Observatory, the principal scientific instrument in the building. This apparatus is unique of its kind in the whole world; wonderfully combined by the illustrious Professor, well constructed by M. Brassart, a Roman artist, worked by an electric clock made by M. Detouche, it enregisters, perpetually and automatically, day and night, the indications of all the instruments with which it is in communication, such as the barometer, thermometer, psychrometer, anemometer. Thus the observer finds it records every morning, week, or month faithfully and continuously inscribed. During our inspection of this instrument, the Baron de Havelt, Pontifical Commissioner, took this learned Jesuit away to present him to His Majesty the Emperor. Let us remark, also, the very remarkable works of art arrived from Rome: the painting of the Gate of Milan, by Mancinelli; the Prodigal Son, by M. Possy; three mosaics of middling dimensions, yet of incomparable beauty, by artists of the Vatican, and representing a head of St. Peter, the Virgin in the Chair by Raphael, the Virgin and the Infant Jesus by Sasso Ferrata; a piece of sculpture representing a man and woman endeavouring, by climbing a rock, to escape the waters of the Deluge; another representing a little boy giving to a young girl his dove, and many others too numerous to mention. The sculptures of M. Lucardi and the Contessa de Colonna (exhibiting under the name of Marcello) also expose some fine works, which received marked attention from their Majesties during their passage.

The Emperor and Empress left the Tuileries at 1.45 p.m., and arrived at the principal entrance of the Exhibition at 2 p.m. exactly. They were received, on alighting, by the Princess Mathilde, the Prince of Orange, the Count of Flanders, the Duc de Leichtenberg, and the Prince and Princess Murat.

At the door of the great vestibule they were received by the Imperial Commissioners and the Ministers, the Prefect of the Seine, Marshals, &c., and, preceded by the Commission, formed a *cortége*, which visited the building, after which it was open to the public. The entrance price for the day was 20 francs; it is to be 5 francs till Monday, April 8.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Saturday, March 30.

Professor W. A. Miller, M.D., V.P.R.S., *President, in the Chair.*

At this the anniversary meeting of the Society there was an unusually large attendance of Fellows.

The President read a report of the proceedings of the past year, from which it appeared that the finances and general condition of the Society were in a very flourishing condition. The present number of Fellows was 499, against 482 last year, and three foreign members had been added to the list, making in all 40, which is the full complement. It had been found necessary to remove, according to the Society's fourth by-law, and for non-payment of subscription, fourteen members; seven others have resigned, and the list of deceased Fellows included as many as eleven. These were Dr. James Allan, Mr. James Barrett, Mr. Thomas De la Rue, Mr. E. A. Hadow, Mr. W. M. Hindmarch, Q.C., Mr. Fearnside Hudson, Mr. Simeon Stoikowitsch, Mr. Edward Swann, Mr. John Mercer, F.R.S., Mr. Percival Johnson, F.R.S., F.G.S., and Major James Whitmore. Obituary notices of nearly all the deceased members were read. During the past year no less than fifty-four papers had been communicated to the Society, and four special lectures delivered by Prof. G. Carey Foster, Mr. Vernon Harcourt, Dr Debus, and Dr. Matthiessen respectively. 100*l.* had been voted for the purchase of books on the library account, and the Council had now under consideration a proposal for raising the standard of qualification for Fellowship.

The Treasurer then presented his financial statement, which had been certified by the auditors and showed a balance at the bankers' of 802*l.*, besides an increased investment, now amounting altogether to 1800*l.* Government Consols. The receipts of the Society amounted to 1848*l.* 16s. 1d., including the last year's balance of 762*l.* 8s. 11d. The expenses amounted to 1046*l.* 12s. 5d., including purchase money of 500*l.* Three per Cent. Consols. The outstanding subscriptions were estimated at 250*l.*

The election of officers for the year ensuing was then proceeded with, Messrs. E. C. Nicholson and Alfred Smee being appointed scrutators. The result of the ballot was declared to be exactly in accordance with the printed programme of changes proposed by the Council, and the following officers were duly elected:—For President Warren De la Rue, Ph.D., F.R.S. Vice-Presidents (who have filled the office of President): Sir B. C. Brodie, F.R.S., C. G. B. Daubeny, M.D., F.R.S., Thomas Graham, F.R.S., A. W. Hofmann, LL.D., F.R.S., W. A. Miller, M.D., F.R.S., Lyon Playfair, Ph.D., C.B., F.R.S., A. W. Williamson, Ph.D., F.R.S., Colonel Philip Yorke, F.R.S. Vice-Presidents: F. A. Abel, F.R.S., Walter Crum, F.R.S., J. H. Gladstone, Ph.D., F.R.S., John Stenhouse, LL.D., F.R.S. Secretaries: William Odling, M.B., F.R.S., A. Vernon Harcourt, M.A. Foreign Secretary: E. Frankland, Ph.D., F.R.S. Treasurer: Theophilus Redwood, Ph.D. Other Members of Council: F. Crace Calvert, F.R.S., J. Lothian Bell, Dugald Campbell, W. Crookes, F.R.S., F. Field, F.R.S., David Forbes, F.R.S., G. C. Foster, A. Matthiessen, Ph.D., F.R.S., H. M. Noad, Ph.D., F.R.S., W. J. Russell, Ph.D., Maxwell Simpson, Ph.D., F.R.S., J. A. Wanklyn.

A vote of thanks to the President for his services in the chair during the past year was moved by Mr. Alfred Smee, seconded by Mr. C. Greville Williams, and carried unanimously.

The retiring President, who was warmly applauded, acknowledged the support he had uniformly received both from his brother officers in the Council and the members attending the meetings. Dr. Miller briefly referred to the circumstance of his having been a fellow-student with Mr. Smee at King's College thirty years ago.

Professor J. A. Wanklyn proposed, and Mr. J. Newlands seconded, a vote of thanks to the other retiring officers, and also to the treasurer and secretaries, for their services during the year.

Dr. Odling spoke in acknowledgment, and briefly explained the principles upon which the Council proceeded to draw up the list of officers proposed for election. There were usually five retiring members—viz., one vice-president, and four ordinary members of Council. This year Dr. Stenhouse, the *senior* vice-president, remains, because Dr. De la Rue leaves that office to become president. Of the four members of Council two will retire by seniority, and two by least attendances. According to

this arrangement Dr. Hugo Müller and Dr. Debus (one *town* and the other *country* member) have necessarily gone out, whilst Dr. Letheby and Mr. Hadow (deceased) have given the other two places. Five vacancies thus created have been filled as follows:—Dr. J. H. Gladstone has become a vice-president, and Dr. A. Matthiessen an ordinary member of Council; there were besides three newly-elected members who have never served before—one from Newcastle, Mr. J. Lothian Bell, had a claim from the fact of his having stimulated the production of sodium and aluminium, besides according a magnificent reception to the chemists during the visit of the British Association. Mr. David Forbes was eminent as a mineralogical chemist, and would doubtless have been elected into the Council before but for the circumstance of his having been so long away from this country. And, finally, Professor J. A. Wanklyn was a good representative of pure chemistry, and an industrious worker in the science.

Other votes of thanks were passed in favour of Mr. H. Watts, librarian and editor of the journal, and also to the scrutators for their aid on this occasion. The meeting was then adjourned until April 4.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, March 29, 1867.

Professor Frankland "*On the Water Supply of the Metropolis.*" Professor Frankland gave a long and interesting lecture on the above on Friday last, commencing with the subject of cholera epidemics. The lecturer spoke of the influence of the water supply both on the amount and the severity of the disease. He illustrated the first by the extent of the disease in Manchester, supplied by the springs of Derbyshire, and the second by the comparison of the mortalities of the former epidemics, when the Thames water was taken below Battersea Bridge, as compared with that of last year, when all the Thames water used by the metropolitan companies was taken from the river at Teddington Lock. A very different effect resulted from the use of the water from the Old Ford reservoir of the East London Company. The influence of this water upon the mortality of the immediate district being suspected by the Registrar-General, an examination had been proposed to the lecturer, who had demonstrated that, by infiltration of the soil by impure matter, the water must have been affected. This was amply confirmed when the reservoir was emptied by pumping. Nine companies now supply to the metropolis 108,000,000 gallons of water daily, but little idea of the vast volume of water is given by mere figures. Its storage would require a reservoir of the size of Westminster Hall, with its walls raised to a height of 1070 feet—more than three times as high as the Victoria Tower. Five of these companies took about half of the whole supply from above Teddington Lock, two of them (East London and New River) used the Lea, while the Kent and South Essex obtained theirs from artesian wells and springs. The metropolitan daily supply is at present 30 gallons per head.

There are five different schemes that have at present been proposed for a better supply:—1st. That of Mr. Bateman, from the sources of the Severn. 2nd. That of Messrs. Hemans and Hassard, from the lakes of Cumberland and Westmoreland. 3rd. That of Mr. Telford Macneil, from the district of the Bagshot sands, with a natural filtration through the sands. By the 4th scheme, from the sources of the Thames, by large reservoirs, with a larger supply than at present. The 5th from the hills of Derbyshire and Stafford, from the slope opposite that by which Manchester is at present supplied.

Of the last three schemes the lecturer said that too little was known of their details for them to be discussed. The quality of the water was not known to him, and the lecturer wished to confine himself to the chemistry of the water, and leave out of question the engineering details.

Mr. Bateman's supply was from the sources of the Severn. From the moisture of the Atlantic and the height of the surrounding hills, the rainfall here is very great, being from 90 to 150 inches per annum. The supply by this means would be 120,000,000 gallons daily, 12,000,000 gallons in excess of the present supply, and the supply would be constant; the length of the aqueduct would be 182 miles, and the cost would be 8,600,000*l*. This might easily be paid by a rate of 10d. in the pound on the metropolis. The lecturer found that at present he paid at the rate of 1s. 5d. in the pound for his water supply, so there would be no grievance on the score of cost. The water of Bala Lake was a specimen of this supply, and it would be superior to any in England as regards purity, and not inferior even to that of Glasgow at the present time.

The Westmoreland district would be the source of Messrs. Hemans and Hassard's supply. The lecturer found by reference that here a dry day was the exception. Of the 365 days of the year, it rained on 229 and 243 days respectively at two of the localities in the district, while at Borrowdale the number of rainy days was no less than 332. This water was received and stored in natural lakes. Three of these would be used—viz., Ulleswater, Thirlmere, and Haweswater.

The lecturer did not think that the beautiful scenery of the district would be interfered with by the necessary works. In favour of the scheme it might be stated that no large reservoirs would be required, but this saving was more than counterbalanced by the large amount of tunnelling that would be necessary. He did not think himself justified in giving opinions on the engineering points of the scheme, but he must mention that one such tunnel would be eight miles in length; the distance from the metropolis would be 240 miles. It would not be necessary to alter the beds of the lakes, but embankments would be required to adapt them for reservoirs. 200,000,000 gallons would be daily supplied to the metropolis, and 50,000,000 would be allowed for the large towns along the course of the aqueduct. The cost was greater than that of the other plan, being 12,200,000*l*., and the rate required would be equivalent to 1s. 1d. in the pound; this also is less than the present cost.

The quality of water from both sources of supply was excellent, and the preference could be given to neither. Specimens of both were exhibited on the table, taken during times of flood.

In reference to the chemical quality of the present supply, the lecturer said that the impurities are of two kinds—1st, those mechanically suspended only, and capable of removal by filtration; 2nd, those that are dissolved in the water. The quality of all the metropolitan waters varied in this respect from slight differences of filtration and storage by the various companies. The New River water was very similar to that of the Thames in February last as regards impurity, but the Kent water on evaporation gave a greater residue in each case. Large diagrams with comparative curves illustrated the matter that was expelled from water by temperature. The water of 1866 was much purer than that of 1865. Of the matters expelled by heat there were—1st, organic matter; 2nd, products of decomposition of certain salts, chiefly nitrates and nitrites; 3rd, ammonia and other volatile bodies. The process of ignition to drive off the organic matter and ammonia was shown by the lecturer, but there might be more organic matter in water than was shown by ignition. This manner of determination had long been thought unsatisfactory by chemists, and a more definite test was sought by the use of permanganate of potash, which was decolorised by organic matter. It was generally supposed that it would oxidise all organic matter in water. Some chemists even have used it as an absolute test. But, by definite experiments made by the lecturer, this method of estimation

is shown to be worthless. 3 grains of each of the following organic substances were introduced into some distilled water, and the permanganate test only estimated the following amounts :—

	Amount contained.	Amount estimated by permanganate.
Gum arabic.	3 grains	·082 grains
Cane sugar.	3 ,,	·051 ,,
Starch	3 ,,	·114 ,,
Gelatine	3 ,,	·634 ,,
Creatine	3 ,,	·064 ,,
Alcohol	3 ,,	·074 ,,
Urea	3 ,,	·074 ,,
Oxalic acid.	3 ,,	2·998 ,,

The only correct result being given by oxalic acid, the standard deoxidiser used. The same fact was illustrated to the audience by several large vessels containing water with various kinds of organic matter, and a definite measure of the permanganate was added to each until there was discoloration, when another measure was added, &c. The vessel that required most measures was a sample of water without any organic impurity whatever. These grave defects attending the above system induced him, with the valuable assistance of Mr. Armstrong, to replace it by a more precise and definite method. By these determinations they estimated the amount of organic matter, and also the hardness. They first determined the carbon and hydrogen by the ordinary methods; then the total nitrogen in the substance; then the nitrogen of the nitrates and nitrites separately; finally the nitrogen of the ammonia; and then deduced from these determinations the nitrogen of the organic matter. This nitrogen has long been insisted upon as of grave importance, but the suggestion before the present time had never been acted upon.

By tabulated results obtained by the above methods we could trace the history of the sewage contained in the water, past or present. As it travels along the stream, the carbon and hydrogen of the original impurity disappear by oxidation, forming water and carbonic acid, but the nitrogen is left like a skeleton, and from it we can trace its history. That which has been oxidised by the stream appears as nitrates and nitrites, and the amount still existing as organic nitrogen is found by deducting this from the sum total. An allowance has to be made for the nitrates and nitrites contained in ordinary rain-water; and when this correction was made, and the test applied to the metropolitan waters, not a trace of organic nitrogen was to be found. These results must be considered as very satisfactory.* A history of the water is thus obtained by its nitrogen. The hardness was determined by the usual soap test. Hardness is caused by the salts of magnesia and lime, but chiefly in London water by the lime dissolved by the carbonic acid in the water. This was illustrated by passing a current of carbonic acid through a vessel of lime-water. From this hardness a difficulty in washing the body is found, from the deposition in the pores of the skin of the insoluble stearate of lime. On entering a new district we can thus at once tell whether the water is hard or soft, by noticing the manner in which the people wash their hands. If the water be hard, they take their hands out of it to cleanse them from the curdling of the soap, but if it be soft the hands are kept and washed in the water. In conclusion, the lecturer said that, as it would be some time before any scheme could be available, it was most desirable, in the meantime, both to reduce still further the organic matter in water, and to obtain a constant supply. In fulfilling both of these requirements he could see no difficulty.

* Sewage contamination of water in 100,000 parts as estimated in 1866 :—

	February.	March.
Chelsea	2420 ...	2565
West Middlesex	2630 ..	2205

ACADEMY OF SCIENCES.

(FROM OUR OWN CORRESPONDENT.)

March 25, 1867.

M. EMILE DUCHEMIN communicated at the last meeting some very important observations on a thunder-stroke at Fecamp. The electric fluid did not spare the lighthouse, furnished with a lightning conductor, more than the houses in the town which were not thus provided. The gigantic electric spark passed through the tower, breaking everything in its course, even as far as the marble pavement, which it smashed before entering the earth. The evident cause of the inefficiency of the lightning-conductor was that its extremity was plunged into a cistern of waterlined by a thick coating of Portland cement.

M. Pouillet warmly thanked M. Duchemin, and declared that the chain was never put with his consent into a spot simply humid.

M. Guerin Menneville read a note on the eggs of silk-worms laid in South America, in Chili or Peru, and which possess the singular character of not being hatched for two years after being laid. On this occasion he ascertained that certain silkworms infected by the corpuscles discovered by M. Pasteur had given good results, whereas the eggs without corpuscles have failed; so that the only way of being sure of the good quality of the eggs is to obtain them from a country in which the epidemic has not broken out in the silkworms.

M. Darreste concluded, from the observations of monstrosities, that certain individual deformities can become the starting-point of an animal race; or, at any rate, that animals can be produced in the domestic line, presenting certain anomalies which reproduce very correctly the anatomic characters of another race. M. André Sanson protests against these combinations, and considers each species as absolutely fixed—that its characteristic is the reproduction of a determined type, as that of the species is of indefinite reproduction.

M. Dumas read a note upon the two masses of meteoric iron sent to the Museum of Natural History from North America; one is that sent from Mexico by Marshal Bazaine. These specimens of meteorological iron are remarkable by their white hue, softness, and the brilliant polish it takes.

M. Regnault presented, in the name of M. Deleuil, an excellent air-pump, of double action, exhausting and condensing, capable of creating a vacuum of one millimetre, also compressing to the pressure of five atmospheres. This unexpected success has been obtained by the application, under very improved conditions, of the system in which the piston is free and without any packing except a layer of air which separates it from the barrel of the pump. This layer of air is now only the $\frac{5}{10000}$th part of an inch; but M. Deleuil makes it very long by giving to the piston a length equal to three of its diameters. Its efficiency as an exhauster is thus greatly increased; the machine makes almost a complete vacuum, and preserves it indefinitely without the necessity of taking any of the parts asunder. The heat disengaged is not appreciable, or is reduced to that of the compression of the air. By making use of a thick pump barrel, M. Deleuil can obtain a pressure of eight to ten atmospheres. M. Regnault explained, and commented upon, the great progress realised by this experienced French instrument-maker—the more important as the use of the vacuum and of compressed air is every day becoming more general in the industrial arts.

M. Le Verrier announced that M. Gallos, director of the Observatory at Breslau, had determined the identity of the orbit of one of the swarms of shooting stars of April, of which the radiant point is well defined, with the comet of 1861.

Owing to the opening of the Paris Exhibition, the weekly meeting of the Academy was postponed from Monday to Tuesday last. Our report of the meeting arrived too late for insertion in this number.

NOTICES OF BOOKS.

Chemistry, Inorganic and Organic. With Experiments and a Comparison of Equivalent and Molecular Formulæ. By C. L. Bloxam, Professor of Practical Chemistry in King's College, London, &c., &c. 8vo. 1867. Churchill and Sons.

Two courses are open to the writer of the present day in the construction of an elementary treatise on chemistry. He may choose as his first object the presentation of a clear and comprehensive account of the modern theories by which the facts of the science are classified; or, regarding facts as of more importance than theories, he may assign to the latter a subordinate importance in his book, and strive mainly to incorporate the greatest possible number of those facts which he deems most important to his readers. Both classes of books are in the highest degree useful; but the method proper to each of them is essentially distinct. Few will venture to deny in the abstract that a systematic and scientific arrangement is best; but such an arrangement involves the devotion of so much space to theory and the description of so many compounds which are unimportant in themselves, and are simply interesting from their structural relations, that, unless the book is to be a very large one, practical details are sure to suffer.

Professor Bloxam has given us a most excellent and useful practical treatise. His 676 pages are crowded with facts and experiments, nearly all well chosen, and many quite new even to scientific men. He has the happy art of selecting the precise points which are likely to be useful to his readers, and describes them clearly in few words, without the omission of anything important. No faculty could be more important in a writer. How often do we meet with pretentious works published at four times the price of this one, in which a woful experience has taught us that we can always find everything except just the thing we want to know! Every one has in his library a dozen such books, and he soon learns to look upon them with scorn and aversion. On the other hand, we all know comparatively small works, which are kept always at hand, and to which we turn hopefully, even after failure in the pages of a bulky rival. It is high praise to say that Professor Bloxam's book will rank with such favoured friends, but we believe ourselves perfectly safe in asserting it. It is astonishing how much important information he often conveys in a few paragraphs. We might quote fifty instances of this, but will content ourselves with one or two as samples. Here is a portion of the author's account of the sulphuric acid manufacture:—

"The sulphuric acid is allowed to collect on the floor of the leaden chamber until it has a sp. gr. of 1·6, and contains 70 per cent. of oil of vitriol, HO,SO_3. If it were allowed to become more concentrated than this, it would absorb some of the nitric oxide in the chamber, so that it is now drawn off.

"This acid is quite strong enough for some of the applications of sulphuric acid, particularly for that which consumes the largest quantity in this country—namely, the conversion of common salt into sulphate of soda, as a preliminary step in the manufacture of carbonate of soda. To save the expense of transporting the acid for this purpose, the 'vitriol chambers' form part of the plant of the alkali works.

"To convert this weak acid into the ordinary oil of vitriol of commerce, it is run off into shallow leaden pans set in brickwork, and supported on iron bars over the flue of a furnace, where it is heated until so much water has evaporated that the sp. gr. of the acid has increased to 1·72. The concentration cannot be carried further in leaden pans, because the strong acid acts on the lead and converts it into sulphate—

$$2HO,SO_3 + Pb = PbO,SO_3 + 2HO + SO_2.$$

"The acid of 1·72 sp. gr. contains about 80 per cent. of true oil of vitriol HO,SO_3, and is largely employed for making superphosphate of lime, and in other rough chemical manufactures. It is technically called 'brown acid,' having acquired a brown colour from organic matter accidentally present in it.

"To convert this brown acid into commercial oil of vitriol, it is boiled down, either in glass retorts or platinum stills, when water distils over, accompanied by a little sulphuric acid, and the acid in the retort becomes colourless, the brown carbonaceous matter being oxidised by the strong sulphuric acid, with formation of carbonic and sulphurous acids. When dense white fumes of oil of vitriol begin to pass over, showing that all the superfluous water has been expelled, the acid is drawn off by a siphon.

"The very diluted acid which distils off is employed instead of water on the floor of the leaden chamber."—P. 205.

Details like these, abundant in all parts of the book, are particularly numerous in the descriptions of "the various substances employed in warlike stores;" and the accounts of gunpowder, guncotton, the metallurgy of iron and copper, the manufacture and properties of chlorate of potash, &c., leave nothing to desire. The section on gunpowder, which occupies fourteen pages, is particularly clear and complete.

But there is probably nothing in the book which will interest the practical chemist so much as the descriptions of lecture experiments which occur in almost every page. Every lecturer knows how constantly and eagerly he is compelled to look out for new experiments. The old ones become so hackneyed—we become so tired of the time-honoured charcoal in oxygen, and sugar turned into charcoal—that, were it only for our own sakes, we should hail any modification with delight. As a first-rate lecturer, Professor Bloxam has improved and altered the stock experiments until in some cases we hardly know them again. He is fertile in "dodges," and often illustrates a familiar fact by an experiment so simple and yet so pretty that we wonder we had not thought of it before. We will venture to quote a few which strike us, though it is very possible that some of them may have been borrowed by our author. It will be seen that some are but slight modifications of very familiar experiments.

Here is one which was first employed, we believe, by Professor Bloxam in a lecture at the Royal Institution some time ago:—

"By exposing a fragment of recently calcined wood charcoal under a jar filled with hydrosulphuric acid gas for a few minutes, so that it may become saturated with the gas, and then covering it with a jar of oxygen, the latter gas will act on the former with such energy that the latter will burst into vivid combustion. The jar must not be closed air-tight at the bottom, or the sudden expansion may burst it."—P. 58.

Many pretty illustrations of the nature of flame are given. We select three very simple ones:—

"Over an ordinary candle flame (Fig. 1) a tube may be adjusted so as to convey the finely divided carbon from the luminous portion of the flame into the flame of hydrogen, which will thus be rendered as luminous as the candle flame, the dark colour of the carbon being apparent in its passage through the tube."

Fig. 1.

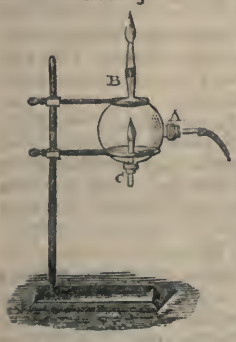
"A bottle furnished with two straight tubes (Fig. 2) is connected with a reservoir of hydrogen. One of the tubes is pro-

Fig. 2.

vided with a small piece of wider tube containing a tuft of cotton wool. On kindling the gas at the orifice of each tube, no difference will be seen in the flames until a drop of benzol ($C_{12}H_6$) is placed upon the cotton, when its vapour, mingling with the hydrogen, will furnish enough carbon to render the flame brilliantly luminous."

"A quart glass globe with three necks is connected at A (Fig. 3) with the gas pipe [coal-gas] by a vulcanised tube. The second neck (B) at the upper part of the globe is connected by a short piece of vulcanised tube with a piece of glass tube about ½ inch wide, from which the gas may be burnt. Into the third and lowermost neck is inserted, by means of a cork, a thin brass tube C (an old cork-borer) about ⅓ inch in diameter. When the gas is turned on, it may be lighted at the upper neck, and if a lighted match be then quickly thrust up the tube C the air which enters it will take fire and burn inside the globe."—Pp. 94-95.

Fig. 3.



The next experiment we will quote is analogous to the last, and might well accompany it in a lecture:—

"If a little chlorate of potash be melted in a deflagrating spoon, and plunged into a bottle or flask containing coal-gas, the salt burns with great brilliancy, its oxygen combining with the carbon and hydrogen in the gas, which becomes in this case the *supporter of combustion*."—P. 158.

Our readers will not have failed to notice in these short extracts the extreme conciseness and clearness of Professor Bloxam's style. He writes very much as he lectures, and we can hardly give higher praise.

The old equivalents are adopted throughout the book, though the new system is described and used here and there for special purposes. The author tells us in his preface that he adopted this course from the difficulty of deciding which of the more advanced systems now employed by chemists was entitled to a preference. With regard to formulæ, this difficulty is no doubt most formidable, and every teacher who cares for his pupils' interest must, unless he be a very firm adherent of some one system, look upon it with anxiety and doubt. But this does not extend to the use of atomic weights, and when we consider the great advantages of a general agreement upon this latter point, we cannot but regret that Professor Bloxam has thought it right to retain the old numbers. The adoption of 16 as the atomic weight of oxygen does not necessitate the use of any particular set of formulæ.

As to arrangement, we have already expressed our opinion that the convenient and practical, though somewhat unscientific, method adopted by our author, is, on the whole, well suited to the book. The advantages and disadvantages of the method are seen very strikingly in the section on organic chemistry, which occupies 200 pages of the book. It is very convenient to be able to turn to a chapter on the products of the distillation of coal, and there to find all the mediate and immediate derivatives of tar, from benzol, phenic acid, and naphthaline to the aniline colours and picric acid; and then, turning over a few pages, to be able to compare them with the compounds similarly obtained from wood. But, to balance this advantage, we often find it next to impossible to discover a compound without the use of the index, as, for instance, in the case of methyl, ethyl, and allyl alcohols, which are described in quite different sections of the book. And we must admit some disadvantages in a system which compels us to study the benzoyl and salicyl series, aniline, the nitro-prussides, phenyl-alcohol, and the glucosides, before we are introduced to common alcohol. We do not say that Professor Bloxam is to blame for these defects. They are to a great extent inseparable from the system he has adopted, and they are, in a great part, atoned for by one of the fullest and best indexes we have ever seen—an index which not only gives the common as well as the scientific name of a substance, sometimes in several places, but also includes symbols and many of the most important formulæ, so that the student who looks for $C_{12}H_7N$, will not only be directed to page 455, but will also be informed that it is called aniline.

We close our notice with regret, for Professor Bloxam's book is one which makes criticism a pleasant task.

CONTEMPORARY SCIENTIFIC PRESS.

Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Archives des Sciences. September 25, 1866.

R. Bunsen "*On Flame Reactions.*"

October 25.—A. De La Rive "*On the Study of the Phenomena of Earth Currents.*"—C. F. Schönbein "*On a new Chemical Photometer, based on the Employment of Cyanine;*" "*On the Formation of Peroxide of Hydrogen during the Oxidation of Organic Matter.*"—Ladame "*On the Theory of Fogs.*"—Goppelsrader "*On a Fluorescent Solution obtained by treating Fustic with Alcohol;*" "*On the Adulteration of Milk;*" "*On the Composition of the Well Waters of Basle.*"—Müller "*On Testing Milk;*" "*On the Optical Composition of the Electric Light;*" "*On the Sulphurous Spring at Houstrich and at other Localities in the Jura, together with some Methods of Analysing Mineral Waters.*"—Mousson "*On the Influence of Temperature on the Galvanic Conducting Powers of Metals.*"—Hermann "*On some new Instruments—Portable Spectroscope, Maximum and Minimum Thermometer, an Instrument for Measuring the Thickness of Microscopic Objects, an Instrument for Plotting Triangles, and a Self-acting 'Linimeter.'*"—Cauderay "*On the Cause of the Disagreeable Taste experienced when the Negative Pole of a Battery of High Tension is brought into Contact with the Tongue.*"—A. De La Rive: "*Remarks on the same subject.*"—Jenny "*On Pettenkofer's Theory of the Nature of Cholera.*"—M. Delafontaine "*On the Oxides of Niobium.*"—H. Struve "*On Wet Gilding and Electro-gilding.*"

CORRESPONDENCE.

Estimation of Nitric Acid in Well-water and Manures.

To the Editor of the Chemical News.

Sir,—In last week's number of the Chemical News I notice a method of Mr. Horsley's for the estimation of nitric acid in well-water, which appears to me to be a needlessly long and tedious one. I have found the following method to give good results:—Evaporate a quarter or half a gallon of the water under examination to the bulk of about 6 ounces; filter and wash. To the filtrate add pure Na_2CO_3 in sufficient quantity to precipitate all the lime and most of the magnesia, &c., taking care not to add a great excess; otherwise the effervescence produced by the addition of HCl in the next stage of the

process is apt to project some of the residue from the basin. When too much Na_2CO_3 has been added, it is better to add HCl to the filtrate till nearly neutral, stopping short when the solution is still alkaline. The alkaline solution is now evaporated to dryness, 50 grs. of As_2O_3 added, and the whole dissolved in concentrated HCl and evaporated to dryness. The remainder of the process is conducted according to the arsenious acid method for the determination of N_2O_5, given in Fresenius, using ammoniacal chloride instead of ammoniacal sulphate of magnesium. As the As_2O_3 may contain a little As_2O_5, 50 grs. are treated as above, and the amount of arseniate of magnesium and ammonium deducted from that previously found. The As_2O_3 I have just now gives ·50 per cent. $2MgO,(NH_4)_2O,H_2O,As_2O_5$.

Nitric acid in manures may also be estimated by this method, with a slight modification. Thus, if the manure is in a fine state of division, 20 grs. are heated to boiling with 5 or 6 ounces of H_2O, filtered, and washed. The filtrate is then treated with a solution of $CaCl_2$ (a quantity equal to 5 or 6 grs. of $CaCO_3$ is usually sufficient to give lime to all the P_2O_5 present), carbonate of sodium added in slight excess, and the process otherwise conducted as given above. Should the sample, however, be so damp that it cannot be brought into a state of fine division—as is usually the case—100 grs. are used, and the solution filtered and washed into a 5000-grain flask, and filled up to the mark with H_2O. 1000 grs. of this solution, corresponding to 20 grs. of the original sample, are now, after having been well shaken, treated with $CaCl_2$ and Na_2CO_3, as above described.

I am, &c. T. L. PATTERSON.

Greenock, March 27.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Synthesis of Organic Acids (C=12, O=16).—L. Carius. To a mixture of benzol and dilute sulphuric acid at 18°, potassic chlorate is added in very small quantities, the liquid is shaken with ether, the ether gives up on evaporation an acid of the formula $C_6H_7Cl_3O_5$, trichlorphenomalic acid, a trichloro-substituted homologue of malic acid, soluble in water and alcohol, crystallisable, melting at 131—132°. At a few degrees above its fusing point it decomposes, giving rise to another acid now under examination. If shaken with water and zinc powder, it parts with its chlorine, and passes into an amorphous easily soluble tribasic acid, much resembling some of the bodies connected with the sugars, and which may be called phenomalic acid $C_6H_{10}O_5$.

By vigorous action of nascent hydrogen on trichlorphenomalic acid, adipic acid should be produced, but in its stead appears succinic acid identical with that from acknowledged sources.

Trichlorphenomalic acid parts with its chlorine on the slightest provocation; simple ebullition in water is sufficient to decompose it, at least in part. If to its aqueous solution baryta water be added in excess, and the liquid be heated for some time, phenaconic acid, $C_6H_6O_6$, is formed, metameric with aconitic acid and polymeric with fumaric acid. Phenaconic acid is crystallisable, does not decompose below 170°, may be sublimed at a slightly higher temperature, but decomposes if suddenly heated; if boiled with nitric acid it yields oxalic acid, but no nitrocompound; its molecule contains H_3 basylous; all its salts are crystallisable, and most of them are soluble in water.

In the preparation of trichlorphenomalic acid there are also obtained oxalic acid, an uncrystallisable chlorinetted acid, apparently of similar constitution to trichlorphenomalic acid, possibly monochlorbenzol, and some tar-like bodies.—(*Sitzungsber. d. Gesellschaft. d. g. Naturwissensch.*, 1867, 21.)

Hydrocarbon, a New (C=12).—C. Friedel and A. Ladenburg. The existence of silicium ethyl, containing one atom of silicium and four molecules of ethyl, and having the functions of a saturated hydrocarbon, pointed to an analogous compound in which silicium should be replaced by carbon, which carbon would therefore be saturated by carbon alone. In the same manner as primary, secondary, and tertiary alcohols contain each of them one carbon atom, the four bonds of which are partly saturated respectively by one, two, and three bonds of other carbon atoms, and as these different alcohols may be referred to hydrocarbons of analogous constitution, so it may be presumed that a quaternary hydrocarbon may exist, in which one carbon atom will be saturated exclusively by other four carbon atoms.

In methylchloracetol, resulting from the action of phosphoric pentachloride on acetone, it is most probable that one carbon atom is united with two carbon atoms and two chlorine atoms; if, therefore, the two chlorine atoms be replaced by two hydrocarbon radicles, the quaternary hydrocarbon sought for will be obtained.

Zinc-ethyl, heated with methylchloracetol, gives rise to enormous quantities of gas — probably propylen and ethylen. The greater part of the residue, when freed from excess of zinc-ethyl and further purified, boils between 86° and 90°, and is hydride of heptyl C_7H_{16}, or, as it may be called from the mode of its formation, carbodimethyldiethyl.—(*Bull. Soc. Chim. Paris*, 1867, 65.)

Hydrocarbons, their Compounds with Picric Acid.—M. Berthelot. These compounds are produced with much difficulty, being decomposed by excess of the solvent used. It is indispensable to success that they separate from a liquid previously saturated by the parent substances; but each hydrocarbon requires the adoption of special artifices. In general, the most fit solution of picric acid is an alcoholic one, saturated at 20°—30°. The most easily obtained is the naphthalen compound. The naphthalen, reten, anthracen, chrysen, and benzerythren compounds are described. An article on the qualitative separation of hydrocarbons by means of picric acid concludes a paper replete with details of operating.—(*Bull. Soc. Chim. Paris*, 1867, 30.)

Camphor, Action of Sodium on.—H. Baubigny. Camphor dissolved in toluol is violently attacked by sodium at 90°; but the reaction can only be explained by the supposition that hydrogen is replaced by sodium in one portion of camphor, and in the nascent state combines with another portion of camphor, converting it into borneol, the result of the reaction. A full account is promised of two homologues of ethylcamphor — namely, methyl- and amyl-camphor, the properties of which resemble those of ethylcamphor. Methylcamphor boils at about 194° (corr. at 733 millim.). Amylcamphor boils at about 277° (corr. at 736 millim.).—(*Zeitschr. Chem.*, N. F., iii. 71.)

Glycerin, Crystallisation of.—To an account of the observation by Crookes (CHEM. NEWS, xv. 26) of the crystallisation of glycerin under peculiar circumstances, Fittig appends a note stating that a manufacturer at Vienna has also observed the same phenomenon, occurring, however, under different conditions; and as in this case the glycerin had been in an iron tank for more than a year, and was impure at the outset, it has been suggested that the solidification might be connected with the presence of iron in solution.—(*Zeitschr. Chem.*, N. F., iii. 70.)

Potassium, Separation from Sodium, &c.—R. Finkener. To separate potassium from sodium when in presence of sulphuric acid, Finkener proposes the following:—Add chlorhydric acid to the aqueous solution to be analysed; then solution of platinic chloride until the liquid is deep yellow. Add water sufficient, when

boiling, to dissolve the double salt precipitated; evaporate to syrupy consistence, but not dry; extract, and wash on a filter with a mixture of alcohol (specific gravity ·8) 2 volumes, ether 1 volume; decompose, and wash out all the sodic sulphate on the filter with a solution of ammonic chloride. The filtrate, alcoholic extract, and washings contain the sodium. Heat the filter and its contents in a stream of hydrogen—a temperature of 240° suffices; extract the potassic chloride with water, and weigh or titrate with silver solution.

A great excess of sulphuric acid is to be avoided. The ammonic chloride solution dissolves about ·13 to ·26 per cent. of the platino-potassic chloride, but the quantity so lost varies with the strength of the solution, its temperature, and the quantity of free chlorhydric acid in it. On the other hand, the double salt carries down with it about ·16—·35 per cent. sodic salt. Potassium may in like manner be separated from lithium. If potassium, sodium, and lithium are present in the same solution, first separate lithium as lithic phosphate, and then proceed as above, or convert the three into platino-chlorides, extract the sodic and lithic salts with a mixture of alcohol and ether containing a little chlorhydric acid, and wash with a mixture of absolute alcohol 6 volumes, ether 1 volume; the residue is pure platino-potassic chloride. Direct experiments showed that the above method is not vitiated in any degree by the presence of chlorhydric, nitric, phosphoric, arsenic, or boric acids, or salts of magnesium, zinc, manganese, iron, aluminium, nickel, copper.—(*Pogg. Ann.* cxxix. 637.)

Chrysen and Anthracen (C=6).—M. Berthelot. Laurent's pyren is probably identical with Fritsche and Anderson's anthracen, and if Dumas' paranaphthalen is not the same body, it is homologous with it. It is proposed to confine the name chrysen to the hydrocarbon $C_{36}H_{12}$, derived from benzol, described (*Ann. Chim. Phys.*, S. 4, ix. 457). Anthracen is obtained from crude anthracen by distillation, and crystallisation from alcohol; it boils at about 320—330°, and melts somewhere about 213°. A thermometer plunged in melted anthracen does not always indicate the same temperature on the solidification of this body; the melting point varies with the treatment to which the body has been subjected. In passing from the solid to the liquid state, anthracen appears to be capable of taking up an unlimited number of transitory states of equilibrium. It acquires a condition of stable equilibrium only when it is raised to a temperature much above that of fusion. Anthracen has a disagreeable and irritating odour, and, in spite of its high boiling point, evaporates so readily that it is difficult to melt a few grammes of it in a capsule. Its formula is $C_{28}H_{10}$.

The fractions of crude anthracen distilling above 350°, consist probably of homologues of anthracen, among others methylanthracen, which is most likely identical with Dumas' paranaphthalen, tetramethylanthracen, or reten, chrysen, and benzerythren. Methylanthracen and reten, although boiling at a far higher temperature than anthracen, fuse at a lower temperature than that body: thus reten, $C_{36}H_{18}$, differing from anthracen by $4C_2H_2$, melts at 95°; anthracen, $C_{28}H_{10}$, melts at 213°; methylanthracen, $C_{30}H_{12}$ (paranaphthalen), melts at about 180°. Reten and its picrate are more soluble in alcohol than anthracen or its picrate. The anomalous behaviour of these homologues of anthracen is perhaps due to the rapid increase in their percentage of hydrogen—reten containing H 7·7 per cent.; methylanthracen H 6·3 per cent., anthracen H 5·6 per cent. They may, particularly reten, be regarded as formed by the association of two hydrocarbons—anthracen, and a hydrocarbon of the $C_{2n}H_{2n}$ series. The physical properties of reten are about the mean of those of these proximate constituents.

Six fractionations of crude anthracen separate a hydrocarbon boiling at about 260°. More soluble in alcohol, and crystallising itself and its picrate more easily, than anthracen, it cannot be mistaken for that body; nor is it naphthalen, which is more volatile and together with its picrate more crystalline; nor is it phenyl, which does not combine with picric acid. It resembles a body obtained in small quantity by the reaction of ethylen on benzol.—(*Bull. Soc. Chim. Paris*, 1867, 43.)

MISCELLANEOUS.

The Annual Dinner of the Chemical Society.—In accordance with a happy suggestion made at one of the recent meetings of the Society that a public dinner should take place some time before the anniversary meeting, nearly 100 of the Fellows assembled on Wednesday, the 27th ult., at the Albion Tavern, Aldersgate-street, for the purpose of thus instituting some researches on the chemistry of digestion. Dr. Miller, President of the Society, occupied the chair. Amongst the visitors we noticed Brigadier-General J. H. Lefroy, R.A., F.R.S., Lieutenant-Colonel W. F. De la Rue, Professor Stokes, Sec. R.S., Professor Tyndall, F.R.S., Professor Morris, F.R.S., and some others; whilst to enumerate the Fellows of the Society would be to copy from the list nearly all the leading members with but few exceptions. After the usual loyal toasts, the President proposed the "Army, Navy, and Volunteers," associating with it the name of General Lefroy. General Lefroy, who was received with cheers, expressed himself much flattered by the cordial reception he had met with from the many eminent scientific men he saw around him. The profession to which he belonged owed much to the sciences, but particularly to chemical science, from the first application of "villanous saltpetre." He felt convinced, although much had been done in the application of chemical science to the arts of warfare, that still greater applications remained to be discovered, and he considered that a knowledge of chemistry was now indispensable to all those who meant to take up the profession of arms. The chairman then proposed "The Royal and other learned Societies," which was responded to by the Secretary of the Royal Society. Professor Stokes returned thanks on behalf of the Royal Society, and reminded the meeting that it was the oldest of the learned bodies, and embraced all the leading sciences. The progress since made in the various departments of science had compelled philosophers to found special societies, but they might be regarded as offshoots from one parent stem, and he congratulated the members generally upon the great cordiality which existed among the learned bodies. In reply to the toast, "The Chemical Society," Professor Williamson, after speaking of the important position which this Society had attained, which had caused it repeatedly to outgrow the accommodation allotted to it, congratulated the Fellows on the very excellent accommodation which had been allotted to them by Messrs. Banks and Barry in the plans lately submitted to Government for the accommodation of the learned societies on the space situated between Burlington House and Piccadilly. One detail, he was sure, would give satisfaction to every one—the library was to be on a different floor from the meeting rooms. Now he considered that one very important object supplied by these evening meetings of the learned societies was the opportunities which they allowed of investigators who wished for special information on any subject to go to the meeting and "turn up" any particular friend who might be strong on that point, and extract all the information he could out of him. This practice of appealing to living, instead of dead, volumes had gradually given rise to a small supplementary meeting of chemists outside the regular meeting-room, and it frequently happened that an animated discussion in the one slightly interfered with the appreciation of a learned paper in the other. It would therefore be a great satisfaction to many present to know that, the two rooms being on different floors, the more animated meeting

could assemble without having their consciences disturbed by entreating messages from the Secretary to make a little less noise. The next toast was "The President elect," in reply to which Dr. Warren de la Rue, who was received with great applause, reminded the meeting that he was not yet the President elect, but rather the President *select*, or *possible* President. He regretted that he had not done more for science, but he possessed an ardent love for it in all its branches, and every moment he could spare from business he devoted to its service. Should he be honoured by being elected President, he would endeavour to promote the interests of the Chemical Society in every possible way. The next toast was the "Visitors," which was briefly responded to by Professor Tyndall; he felt with shame that he was there as a visitor instead of a Fellow, but he assured the meeting that this was from no want of love for chemical science or of appreciation of the advantages to be derived from attending its meetings, but it was entirely due to the fact that, amidst the engrossing investigations which occupied his time, the duty which he owed of applying for admission to the Fellowship had not presented itself to him with sufficient prominence. He spoke in warm terms of commendation of the treat which he had experienced that evening in the practical illustration he had had of "sonorous vibrations," a subject which, however deeply he might experiment upon it, he could never of himself illustrate in so pleasing a manner. The other toasts were the "Officers," which were replied to by Drs. Odling, Redwood, and A. V. Harcourt, Esq. The sonorous vibrations referred to by Professor Tyndall were the very excellent musical interludes with which the toasts were alternated. These consisted of the National Anthem, sung by Mr. Spiller, accompanied by Professor Abel on the pianoforte; comic song, by Colonel De la Rue; four-part songs "Oh! who will o'er the downs," and "O hills, O vales of pleasure," by Messrs. Brown, Williams, Spiller, and Bassett; a pianoforte solo *potpourri*, by Professor Abel; and a German chorus, "Das Morgenroth," sung by Drs. Hugo Müller, Sprengel, Francis, Russell, Roscoe, and Tyndall. The song of the evening, however, was Mr. Field's "The Chemists' Dinner." The happy manner in which the author, by a few appropriate allusions, referred to one chemical celebrity after another, presenting each in his own characteristic peculiarity, without saying a word which could give offence to any one, shows that the author's tact and geniality are of as sterling a character as his poetical and chemical attainments.

Paris Exhibition.—The following is a list of jurors and associates appointed for the various Classes in which our readers are likely to take most interest. Class 7. Paper stationery, binding, painting and drawing materials; juror, Mr. Warren De la Rue, F.R.S.; associate juror, Mr. F. Hankey. Class 9. Photographic proofs and apparatus; juror, Dr. Hugh W. Diamond; associate juror, Lieutenant-Colonel Gordon, C.B., R.E. Class 11. Medical and surgical instruments and apparatus; juror, Sir J. F. Olliffe, M.D. Class 12. Mathematical instruments and apparatus for teaching science; juror, Mr. C. Brooke, M.A., F.R.S.; associate juror, Lieutenant-Colonel Strange, F.R.S., F.R.A.S. Class 24. Apparatus and processes for heating and lighting; juror, Professor J. Tyndall, LL.D., F.R.S.; associate juror, Rear-Admiral Ryder, C.B., R.N. Class 25. Perfumery; juror, Dr. W. Odling. Class 36. Jewelry and precious stones; juror, Earl Dudley; associate juror, Mr. N. H. M. S. Maskelyne. Class 40. Mining and metallurgy; juror, Mr. S. H. Blackwell; associate juror, Captain W. S. Roden. Class 41. Products of the cultivation of forests, and of the trades appertaining thereto; juror, Hon. F. D. M'Gee; associate juror, Mr. P. L. Simmonds. Class 43. Agricultural products (not used as food) easily preserved; juror, Mr. D. Hanbury; associate juror, Dr. T. Thomson, F.R.S. Class 44. Chemical and pharmaceutical products; juror, Dr. Frankland, F.R.S.; associate juror, Dr. David Price. Class 45. Specimens of the chemical processes for bleaching, dyeing, printing and dressing; juror, Sir Robert Kane, F.R.S.; associate juror, Dr. David Price. Class 47. Apparatus and processes of the art of mining and metallurgy; juror, Mr. W. W. Smyth, M.A., F.R.S., Pres. G.S.; associate juror, Mr. C. Le Neve Foster. Class 51. Apparatus used in chemistry, pharmacy, and in tan yards; juror, Dr. Lyon Playfair, C.B., F.R.S.; associate juror, Professor T. C. Archer. Class 59. Apparatus and processes used in paper-making, dyeing, and printing; juror, Mr. Wyndham S. Portal. Class 64. Telegraphic apparatus and processes; juror, Mr. C. Wheatstone, F.R.S.; associate juror, Lord Sackville Cecil. Class 67. Cereals and other eatable farinaceous products, and the products derived from them; juror, Mr. J. Druce; associate juror, Mr. C. Woolloton. Class 72. Condiments and stimulants; sugar and confectionary; juror, Mr. G. Moffatt, M.P. Class 73. Fermented drinks; juror, Hon. H. G. Howard; associate juror, Mr. E. L. Beckwith.

Meetings for the Week.

Monday, April 8.

Royal Medical and Chirurgical Society, 8½ p.m.

Tuesday, April 9.

Royal Institution, 3 p.m. Rev. G. Henslow "*On Botany.*"

Photographic Society, 8 p.m.

Thursday, April 11.

Royal Institution, 3 p.m. W. Pengelly, Esq., "*On the Antiquity of Man.*"

Royal Society, 8½ p.m.

Friday, April 12.

Royal Institution, 8 p.m. Mr. Balfour Stewart, F.R.S., "*The Sun as a Variable Star.*"

Saturday, April 13.

Royal Institution, 3 p.m. W. Pengelly, Esq., "*On the Antiquity of Man.*"

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

J. H. Swindells.—Received with thanks.

An Old Subscriber.—We will forward the request to our Paris correspondent, who will doubtless attend to it.

R. C. C., &c.—We shall be glad to receive a condensed account of the more salient points of the results of your observations quarterly; but please make them short, and avoid tables if possible.

J. W. Y.—Your paper is received with thanks. It shall be inserted next week if possible.

A. B. wishes to know whether anywhere in this country illuminating gas is produced by conducting a current of air through volatile hydrocarbons; if so, with what practical success, and with what kind of hydrocarbons.

J. W. wishes to know what is the colouring matter in commercial acetate of alumina. He will find the prices of drugs and chemicals regularly quoted in the *Public Ledger*. Iron liquor is made by heating 20 gallons of acetate of lime liquor at 24° Twaddell in a copper to 140° F. Then add 65 lbs. of green copperas in coarse powder, and stir till dissolved. Finally add 2½ gallons of common pyroligneous acid. The product will be 16 gallons of iron liquor at 16° Twaddell.

A Constant Reader.—We feel obliged to decline the article in its present form. If you will rewrite it, very much condensed, we will try and find room for it, but the demands on our space are now so great that we are obliged to insist upon brevity in all such articles as this one.

Microscopist.—Santonine, salicine, and cinchonidine are very beautiful objects for the microscope, when viewed by polarised light. The best method of mounting each is not described in books. Probably allowing a strong alcoholic solution to dry, or fusing some on the slide, and subsequent mounting in Canada balsam, would give you good results. If any of our correspondents have had experience in these matters, we shall feel obliged if they will favour us with a few details.

Horsley's Powder.—This consists of three parts of chlorate of potassium and one of gall-nuts, ground, dried, and sifted together. We have had an account of some experiments forwarded to us, from which it appears that, volume for volume, the disruptive force of this powder is fifteen times greater than that of gunpowder. We fear, however, that the great danger of all explosive materials in which chlorate of potash is used will prevent a powder of this kind from coming into general use.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Application of the Blowpipe to the Quantitative Determination or Assay of certain Metals, by David Forbes, *F.R.S., &c.**

(*Continued from page* 166.)

Cupellation.—The bone ash required for this process should be of the best quality and in the most impalpable powder, prepared by elutriating finely-ground bone ash, and drying the product before use.

The cupel still hot from the last operation is placed upon the anvil, and the crust of litharge, with its enclosed metallic bead, gently removed, leaving the hot coarse bone ash beneath it in the mould; upon this a small quantity of the elutriated bone ash is placed, so as to fill up the cavity, and the whole whilst hot stamped down by the bolt, previously slightly warmed, with a few taps of the hammer. The cupel thus formed is heated strongly in the oxidating flame, which should leave the surface perfectly smooth, and free from any fissures or scales; if such appear, the bolt must again be used, and the cupel re-heated. In this process it is very important that the cupel should possess as smooth a surface as possible, whilst at the same time the substance of the cupel beneath should not be too compact, so as thereby to permit the litharge to filter through and be readily absorbed, leaving the silver bead upon the smooth upper surface.

The bead of silver-lead obtained from the last operation is taken out of the litharge in which it is embedded, and, after removing any trace of adherent bone ash or litharge, is slightly flattened to prevent its rolling about upon the surface of the cupel.

It is now put into the cupel prepared as before described, placing it on the side furthest from the lamp and a little above the centre of the cupel, which is now inclined slightly towards the lamp, and is heated by the oxidating flame directed downwards upon it, this causing the globule when fused and oxidating to move of itself into the centre of the cupel. The cupel is now brought into a horizontal position, and the flame, directed on to it at an angle of about forty-five degrees, is made to play upon the bone-ash surface immediately surrounding the globule, without, however, touching it, so as to keep this part of the cupel at a red heat sufficiently strong to insure the globule being in constant oxidising fusion, at the same time to cause the perfect absorption of the litharge, so as to prevent any scales of litharge forming upon the surface of the cupel under the globule, which would impede the oxidation, as well as prevent the silver bead being easily detached at the conclusion of the operation. Should the heat at any time be too low and the globule solidify, it must be touched for an instant with the point of the flame and proceeded with as before. Should (in consequence of the bone ash not having been sufficiently heated to absorb the litharge perfectly) a little litharge adhere pertinaciously to the globule, or a particle of the bone-ash cupel attach itself, the cupel should be slightly inclined, so as to allow the globule to move by its own weight on to another and clean part of the cupel, leaving the litharge or bone ash behind it; but, if not sufficiently heavy to do so, a small piece of pure lead may be fused to it in order to increase its weight, and so allow of the same proceeding being adopted.

By slightly inclining the cupel stand, and moving it so as to present in turn all parts of the surface surrounding the globule to the action of the flame, the cupellation proceeds rapidly. If, however, the assay contains very little silver, it will be found necessary to move the globule from one spot to another on the cupel, in order to present a fresh surface for absorbing the litharge formed; this is done by simply inclining the cupel stand, remembering that the bone ash surrounding the globule must always be kept at a red heat, without ever touching the globule itself by the flame.

In assays rich in silver a play of iridescent colours appears some seconds before the "brightening," which disappears the moment the silver becomes pure; as soon as this is observed the cupel should be moved in a circular manner, so that the globule is nearly touched all round by the point of the blue flame, and this is continued until the surface of the melted silver is seen to be quite free from any litharge, upon which it is very gradually withdrawn from the flame so as to cool the assay by degrees very slowly, in order to prevent "spitting."

When the silver-lead is very poor, this play of colours is not apparent, and as soon as the rotatory movement of the globule ceases, the heat must be increased for an instant in order to remove the last thin but pertinacious film or scale of litharge, and subsequently the assay is cooled gradually; when cold it should, whilst still upon the cupel, be examined by a lens to see whether the bead possesses a pure silver colour, as if not it must be re-heated.

Frequently, when the "brightening" takes place, the silver globule is found to spread out, and, after cooling, although of a white colour, is found to appear somewhat less spherical or more flattened in shape than a corresponding globule of pure silver would be. This arises from the presence of copper still remaining in the silver, and in such cases a small piece of pure lead (about from one-half to one and a half grain in weight, according to size of assay) should be fused on the cupel along with the silver, and the cupellation of the whole conducted as before on another part of the cupel, when the silver globule will be obtained pure and nearly spherical in shape. Sometimes the silver globule in "brightening" may still remain covered with a thin film of litharge, although otherwise pure; this arises from too little heat having been employed in the last stage of the operation, and consequently the bead should be re-heated in a strong oxidating flame until this litharge is absorbed, and the globule, after slow cooling, appears pure.

If the instructions here given be strictly attended to, it will be found after some practice, that very accurate results may be obtained in the blowpipe assay for silver, and that no difficulty will be found in detecting the presence and determining the amount of silver present, even when in as small a quantity as half an ounce to the ton. When substances containing very little silver or less than that amount are examined, several assays should be made, and the silver-lead obtained concentrated separately, after which the various globules should be united and cupelled together in one operation.

It is hardly necessary to remark that the lead employed in assaying should be free from silver, or, if not, its actual contents in silver should be determined, and subtracted from the amount found in the assay.

Assay lead containing less than one quarter of an ounce to the ton of lead can readily be obtained, or can be made by precipitating a solution of acetate of lead by metallic zinc, rejecting the first portion of lead thrown down. In all cases the lead should be fused and granulated finely—the granulated lead for use in these assays being previously passed through a sieve containing forty

* Communicated by the author.

holes to the linear inch. It is also useful to have some lead in the form of wire, as being very convenient for adding in small portions to assays when on the cupel.

On the Separation of Lanthanum and Didymium, by M. Cl. Winckler.

The separation of cerium from lanthanum and didymium is easily effected, but this is not the case with regard to the mutual separation of the last two metals. The author has recently proposed to separate and estimate cerium by binoxide of mercury and permanganate of potash. He has since ascertained that cerium is not in this case merely precipitated in the state of a peroxide, but is accompanied by didymium, whilst the lanthanum remains in solution. The estimation of oxide of cerium is very little altered, for it gains by its oxidation 5·88 per cent. in weight, whilst didymium only gains 0·38 per cent. in changing from a protoxide to a peroxide ($D_{32}O_{33}$). This is an excellent method for separating didymium from lanthanum.

To find the didymium which accompanies the cerium in its precipitation by permanganate of potash, redissolve the precipitate in hydrochloric acid. After having well calcined it to free it from the oxide of mercury, evaporate the hydrochloric solution to dryness in the presence of sulphuric acid; dissolve the residue of sulphate in water, and add sulphate of potash to it. In twenty-four hours a double sulphate separates, insoluble in sulphate of potash.

$$KO,SO_3 + \left.\begin{matrix}Ce\\Di\end{matrix}\right\} O,SO_3.$$

The precipitate must then be dissolved in water, and the sulphates changed to oxalates, which must be calcined to obtain the oxides of cerium and didymium, which are then separated in the usual way.

The lanthanum in the filtered liquid may be obtained thus:—First treat the filtered liquid with sulphuretted hydrogen, to separate the oxide of mercury, then precipitate the lanthanum as an oxalate, and calcine it. The oxide of lanthanum then contains very little didymium.—*Journal für praktische Chemie*, xcv. 410.

On some Lecture Experiments, by Professor F. Wöhler.

Silicated Hydrogen Gas.—The following apparatus may be used to show that this gas inflames spontaneously and will furnish rings of silicic acid, when using only a small quantity of material.

A two-necked flask holding from 400 to 500 cubic centimetres is filled with water which has been boiled and allowed to cool. To the lateral neck is fixed a small tube, bent to a right angle, and terminated by a little bulb; a tap is fitted to this, to which may be joined by india-rubber a straight drawn-out tube for the escape of the gas. The little bulb must be filled with water. To the centre tubulure is fixed, by means of a cork, a vertical tube having several bulbs in it, and ending in a funnel; and its lower end is contracted and bent so as to prevent the passage of the gas. The pulverised mass is introduced by this tube, care being taken that no air enters at the same time. Pour the concentrated hydrochloric acid in by the large tube, always avoiding the entrance of the air, which causes dangerous explosions. By inclining the apparatus it is easy to make the water run out of the little ball near the tap, and to fill it with gas; the ball is merely to hold the scum formed during the reaction. The large tube should hold almost as much as the flask; were it not so, the excess of liquid might easily be taken away—by a small pipette, for instance.

To insure success in the preparation of the matter containing the silicide of magnesium, too much heat must not be applied after the action of the sodium has taken place; the heat used for the preparation of magnesium suits in this case—only the black pieces filled with little metallic particles should be used, coarsely pulverised. Too finely powdered, they give rise to a great deal of scum.

Liquid Sulphurous Acid.—In using the following apparatus the great cold produced by the evaporation of liquefied sulphurous acid may be rendered sensible without inhaling the gas. The apparatus is entirely of glass, and is composed of a tube with enlargements, terminated at its two extremities by two narrower vertical branches, each furnished with a tap, so that the communication between the interior and the atmosphere may be established or interrupted at will. To fill this recipient, after having plunged it into a mixture of snow and salt, introduce dry gas by one of the taps until the liquefied product fills it about two-thirds; by then shutting the taps the liquid may be preserved as long as is desired. To determine the evaporation of the liquid, adapt to the taps tubes bent to a right angle, and plunge them into cylinders filled with water; open the taps by degrees; the acid which volatilises is entirely absorbed by the water, whilst the liquid part is so cooled that the reservoir of the apparatus condenses the moisture of the air and covers it with a layer of ice. The evaporation, of course, takes place very slowly.

The experiment may be tried in a more simple way. Place a tube, about twelve inches long and half an inch in diameter, closed at one end and drawn out at the other, in a freezing mixture, and fill it three parts with liquid sulphurous acid. Keeping the tube in the freezing mixture, seal up the narrow end before the blowpipe. To determine the evaporation of the liquid acid, incline the tube; adapt to it, by means of caoutchoue, a tube bent at right angles, and plunged in water; then break the point of the tube with blunt pincers.

TECHNICAL CHEMISTRY.

Manufacture of Sulphate of Magnesia, by J. H. Swindells.*

I notice in a recent number of the Chemical News that M. Mirns prepares sulphate of magnesia from the residuals of the manufacture of carbonic acid from magnesite and sulphuric acid. This method is hardly new, and is, I think, scarcely worth the trouble expended upon it. It must be borne in mind that this salt is not now used exclusively as "a useful purgative," and "also for agricultural purposes," as we are informed even in recent works on manufacturing chemistry.

Few people are aware that Epsom salt is now made on a very large scale for the use of warp-sizers. Something like 150 tons per week are disposed of in Manchester for this purpose alone. Perhaps a short account of the manufacture of sulphate of magnesia as now carried on may be of interest to some of your readers, and they can then compare the present method of making it with the past. I will merely give the practical part, leaving the theoretical to your readers.

The plant required consists of—1. A digester, a square wooden box lined with thick sheet lead; on the bottom and about three feet up the sides flags are placed so as

* Communicated by the author.

to protect the lead from the effects of the magnesian limestone, which often shakes about very much. This digester is made of various sizes. 2. A settler, made either of lead or flags well cemented together. Iron should be avoided for this purpose. The settler may be made as large or larger than the digester. 3. An evaporating pan (iron, heated by steam or fire). 4. Coolers, mostly made of wood, but I recommend them to be made of flags or slate, or, better still, one large shallow slate or flag cooler. 5. A drainer for "draining" the salts, made of wood, and of any shape. 6. A stove for drying the salt, formed of wooden shelves any width, and about eighteen inches apart, heated by means of steam passed through pipes along the floor of the stove. 7. A washer for washing the "settlings" of the settler. 8. A steam boiler.

This may be considered the whole of the plant. And now, supposing we have a digester—say, about six feet square and seven feet deep—we commence by placing, say, three tons of magnesian limestone in the digester. We then add the acid—say, twelve ordinary carboys. Now turn in the water till the mixture has a specific gravity of 1125 or 1150. Allow the acid and water to act upon the stone for an hour or so, then turn in the steam, which is supplied by the boiler. A lead pipe of about three quarters of an inch bore is made to go about halfway down the digester, and through this the steam is forced into the liquor. From eight to twelve hours is the time taken to neutralise a "batch."

When sufficiently neutral, the liquor in the digester will stand from 40° to 50° on Twaddell's hydrometer. It is then run off by means of a tap or plug into the "settler." If the liquor happens to show a trace of acid, it is neutralised, and any iron present precipitated by any of the known means. It usually takes three or four hours to "settle." It is then siphoned off into the evaporating pan. The same routine above mentioned is worked over again until sufficient liquor has been obtained for a "boiling;" care is always taken to keep the liquor free from acid—indeed, working on the alkaline test may be said to answer best. The liquor in the boiling-down pan is evaporated till it stands, say, 66° or so by Twaddell. When this point is reached, the steam (if used) is turned off, and the liquor is allowed to remain undisturbed for a few hours, so as to allow all floating particles to settle down. Care is taken that the liquor is very clear before it is run off. When sufficiently settled it is run off into the cooler or coolers, and agitated at stated intervals to make the salt fall in small crystals. When the salt has finished falling, the mother liquid is run off and pumped into the evaporating pan; New liquor from the digester is added, and the same process as already described is gone over again. The salt is taken from the coolers and allowed to drain. It is then placed on the shelves of the stove and dried; the heat of the stove ought not to exceed 80°. When sufficiently dried it is sifted, sometimes crushed, and packed in casks. The settlings from the "settler" are placed in the "washer" and washed, and the liquor is allowed to filter through, when it is pumped into the evaporating pan along with the other liquor.

This may be said to be the whole process. Of course, the object to be aimed at in making sulphate of magnesia is purity and freedom from iron, &c. When iron is present it is easily detected by bisulphohydride of ammonia or by yellow or red prussiate of potash, &c. When used by warp-sizers, it can only be said to add weight. If such salts are to be used, there is no doubt that chloride of barium will in time take the place of Epsoms for sizing purposes. Chloride of barium is much better for this purpose than Epsoms, and by the use of it the cloth is not so liable to mildew; indeed, it acts in the manner of a preventive against that much-heard-of complaint. But it must be understood that a greater weight is added to cloth in the manufacture of which chloride of barium has been used. The injury to cloth —and much has been said on this point—results chiefly from the amount of moisture, &c., which is introduced by the use of various salts. We know that water enters largely into the composition of Epsoms—51·21 per cent. being water; whereas, in chloride of barium, we have only 14·77 per cent. of water, with a specific gravity of 3·049. From this comparison many obvious conclusions may be drawn. The quantity of sulphate of magnesia made yearly may be placed at upwards of 12,000 tons.

PHARMACY, TOXICOLOGY, &c.

The New Pharmacopœia (1867).

[SECOND NOTICE.]

THE book, as yet, is not available for ordinary readers, and so we reserve special remarks upon manufacturing chemical processes till we have full space to note such specialities, and when the text-book can be referred to in support of any statements that may be made. We will, therefore, at present content ourselves with giving the general broad outlines of the book, and when we have done this our readers will be prepared to follow with us the specialities in more detail.

It is well known that our most scientific chemists have taken great interest in the present edition; this was shown by the memorial presented to the Medical Council by the Council of the Chemical Society. The object of this memorial was to urge the omission of all chemical formulæ from the new edition, chiefly on account of the transitionary state of this part of chemistry. This advice seemed sound, but the only other alternative that presented itself has in preference been adopted. Symbols by the older authorities are given in ordinary capitals, and those of the *new system* in thick Egyptian type.

A commentator on this remarks:—"It possesses evident advantage over the method of barred symbols adopted by some authors. The presence of the bar gives a needless appearance of complexity to a formula." The author of this criticism must be in happy ignorance of the depth of profundity to which chemical formulæ have now attained.

The Council, then, in neglecting what may be called expert advice, have assuredly made a grievous error. It is, indeed, melancholy for a committee to write down one old and one new formula, in happy ignorance that there are several old systems of notation and quite half a dozen new ones. Nothing but confusion could possibly come from such policy. Supposing even that *a* new system of notation were adopted, it would have been wise to burden the minds of those seeking knowledge by an empirical formula only; but chemists will be astonished to learn that with new symbols rational formulæ also are given. We give a few examples of the new symbols. Acetic acid is described as follows:—"100 parts by weight contain 33 parts of acetic acid $HO.C_4H_3O_3$ or $\mathbf{HC_2H_3O_2}$, corresponding to 28 parts of anhydrous acetic acid $C_4H_3O_3$ or $\mathbf{C_4H_6O_3}$." This information is either just too much, or, as we think, just too little. To a student nothing could look more similar than the two formulæ given in an old notation—nothing

more dissimilar than the corresponding ones of the new, as given in the text. Of course, the student may choose whichever of the two sets of symbols given he pleases, as long as he is consistent; no one could fairly expect him to know both. But, bad as his case may be, we pity the Materia Medica examiner still more.

By the new chemistry of the Pharmacopœia it is stated that calomel (by the way, altered to the subchloride of mercury) is written $HgCl$, and alum is given as $NH_4Al(SO_4)_2.12H_2O$. Will any one doubt, after these typical examples, the soundness of the advice given by the Council of the Chemical Society?

It is our duty to mention these defects, but we may say that such a criticism is forced upon us by the contrast that is afforded by the general sound treatment of these delicate subjects. The weights and measures are remarkably well treated, and will give dissatisfaction to no one—indeed, we think that the system, as modified by the Committee, will be felt to be a boon by practical chemists who may wish to express any results readily transferred from our own weights to those of the metric system. It will also afford a transition by which the latter may be more gradually and conveniently brought into use. The subject might have been made of equal difficulty with that of chemical symbols, but it is satisfactory to find that two systems are not given as a further means of confusion.

The measure has been replaced by a grain measure in which the weighing of any reagent used for volumetric analyses is necessary. For this purpose, flasks, such as are ordinarily used, are recommended for weighing; thus, in the direction for preparing a weak acid, it is recommended to *weigh x* grains of the strong acid, and then to add distilled water until the mixture after being shaken reaches the mark graduated on the neck of the flask. The old inaccurate measures are thus dispensed with, and this very simple plan, requiring only a little more care, will insure a uniformity hitherto practically unattainable by the ordinary pharmacist. The metric system is not introduced into the body of the work, but its use has been sanctioned in the appendices for volumetric analysis. A grain measure is the volume of a grain of water. In the former edition an arbitrary measure of 10 grains was used, and was called the measure; thus in the directions we formerly read, take of such a liquid *x* measures—*i.e.*, 10-grain measures; but now we should read instead the number of 1-grain measures required.

A cubic centimetre is the volume of a gramme of water; therefore, the relation being the same with that of the grain and the 1-grain measure, the analyst may either neutralise 75 *grains* of tartaric acid by 1000 *grain measures* of the volumetric solution of soda, or 75 *grammes* of the same acid by 1000 *cubic centimetres* of the alkaline standard solution, or still more easily, as far as conveniency of bulk in some cases requires, take 7·5 grammes of the acid with 100 c.c. of the soda solution very readily.

This simple abolition of the arbitrary measure has cleared away all the clumsiness and confusion of the last edition, and those only who have read carefully the preparations for the solutions formerly given can fairly judge of the importance of a slight alteration such as this. This process of weighing in graduated flasks, as replacing measures formerly given, is the only alteration made in this department of pharmacy.

In many cases permissive processes are given for the preparation of various substances where there are two or three equally good ones. This holds in the cases of the preparation of atropia, sulphate of quinine, and others; but for hydrocyanic acid, ether, and others, only one process is given. It will be remembered that the last Pharmacopœia was very exhaustive in its description of preparations, so much so that one would judge superficially that it was the best plan to make everything for oneself and ignore the manufacturing chemist altogether, who of course can prepare a chemical body in a state of purity by a wholesale process at a far cheaper rate. By a deeper study of these preparations, however, a case like the following may occur:—For the preparation of pure nitrate of silver for volumetric purposes, take of pure silver, so much. One then turns to silver, in another part of the book, to find how pure silver is obtained: the direction is—Take of pure nitrate of silver, so much. So an interesting circle is described, and the reader is left in doubt as to whether pure silver or pure nitrate of silver exists in nature or not, and if so, which of the two.

The methods ordinarily used by wholesale manufacturing chemists are now in almost every case stamped with authority, more than one in many cases being so allowed; and this deference to better authorities as regards practicable methods of chemical manufacture is very well timed and in the best taste.

(To be continued.)

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, April 10, 1867.

M. Humbert de Molard presented to the French Photographical Society, at the last meeting, a new instantaneous shutter for photographic cameras, which allows the following problem to be resolved: Given several object glasses, to take on a single plate, in a fraction of a second, as many proofs as there are object glasses, not by uncovering them all at once in the same moment, but one after the other, so that a living person can be represented in the different phases of the movement which takes place in the part of a second for the use of the phenakistoscope. The instrument is composed of a sort of frame set up in front of the object glasses, and pierced with as many holes as there are lenses. The light is excluded by an opaque curtain stretched in the same way as carriage screens, which can exclude the light either instantaneously or at any slowness desirable. The openings are so disposed in the opaque curtain as that, by the movement of ascension, the first coinciding with the first row of objectives, unmasks successively each of the lenses, while the others are screened and the light excluded. The second and the third openings, placed at proper distances, coincide in their turn with the second and third rows of lenses, and expose them successively in the same way as the first aperture. Thus can be obtained, during the time that the curtain takes to extend itself, the twelve or sixteen successive proofs which the phenakistoscope requires to produce a sensation of movement.

The *Moniteur* of the 5th inst. mentions the following meteorological event in terms which appear to have been paid for by the coal and charcoal sellers of Paris. "The '*lune rousse*' commences to-day, April 4. This moon is distinguished by the protracted frosts which are produced while it shines above the horizon. It has not failed in its general routine of habitual programme. The day has been colder than the preceding, and it was only in the afternoon that, after a lengthened drizzly rain, the atmosphere was a little warmed." This audacious assertion has some connexion with those on lunar influence propounded in England by Mr. Harrison, &c.

M. Dubrunfaut, director of the experiments on the cultivation of beetroot by chemical manures, has blamed the operators with having made the comparisons based upon the actual weight of the roots, and not upon the saccharine quality of the same. M. Denoyon, in his name and in that of M. Levy, hastened to respond to this objection, which happily was without foundation. The roots, having given under the influence of chemical manure 60 tons per hectare, furnished more syrup at the first squeezing, and gave 2 per cent. more sugar, than that of beetroots cultivated without chemical manure. Moreover, the molasses of the second squeezing furnished 41 per cent. per hectolitre instead of 40, the amount obtained with the beetroot cultivated with ordinary manures.

At the last meeting of the Academy of Sciences Baron Seguier called attention to a new gun, constructed by a clever gunsmith, M. Galand, who had the fortunate idea of inflaming the cartridge by the summit, and to make the gases act upon the projectile by the intervention of a compressible body, so as to overcome its inertia without shock, as if by a spring successively stretched, which in shrinking renders all the force stored up within it. In the new arm M. Galand fixes a copper cap at the end of a screw acting as a breech. This many-filleted screw enters the chamber sufficiently to form a solid and sure resisting piece. The arm is opened by a slight movement of the hand, and, at the moment of discharge, the copper cap, being very malleable, opens out at the instant of the explosion by the pressure of the gases. The same screw which acts as breech, when unscrewed, easily draws out the copper cap which has been flattened out into the conical space in which it enters at each manœuvre. It is in part hollow, and contains the four pieces of mechanism for percussion of an extreme simplicity. The needle which ignites the charge acts as a detent, a kind of hook replacing the head of the hammer in the action of cocking. To take all the mechanism to pieces, it is only necessary to unscrew a simple bolt. This new firearm costs at most 1*l*. Its form, compared with that of the ancient arms, is rather singular; there being no detent, there can be no accidents. To determine the explosion the pallet inserted into the body of the screw must be pressed by the thumb. The cartridge consists of a small cotton bag, having at its extremity a disc of cotton furnished at its centre with a small quantity of fulminating powder. Five grammes of powder are poured into the bag, a greased wad separates the powder from the ball, and the bag is tied with a ligature. The cartridge leaves no residue whatever after firing. The principal dimensions of the Galand gun are :—Diameter of barrel 10 centimetres; pitch of grooves 1 turn in 75 centimetres of the barrel; weight of ball 26 grammes; charge of powder 5 grammes. The ball penetrates a deal plank at the distance of a thousand metres.

The Duc de Luynes, whose inexhaustible generosity is known and admired by all the world, as far as relates to the sciences and arts, placed at the disposal of the French Photographic Society a sum of 10,000 fr. (400*l*.) as a prize for researches made upon the causes of the alteration of photographic proofs, and the discovery of a method of printing these same in carbon, or some sort of ink that will be indefinitely unalterable. Already in 1859 the Society divided amongst several competitors, MM. Poitevin, Davanne and Girard, Pouncey, Garnier and Salmon, a first sum of 2000 fr. (80*l*.); the Society also named April 1 for the decisive award of the rest of the money, 320*l*., for the complete resolution of the problem theoretically, and the practical application of a process capable of resolving the difficult problem of the application of it in printing positives in unalterable ink. Hindered by some unknown cause, the commission named to decide upon the merits of the works sent in for competition at length reported at the last meeting of the Society, Friday, April 5, and awarded the whole of the 320*l*. to M. Poitevin, who, in 1855, was the first to discover and to apply completely and practically with advantage, a process by which objects are transferred to stone, and printed off in any quantity in a lithographic press. M. Poitevin had many illustrious competitors—MM. Ch. Nègre, Nièpce de St. Victor, Lemercier, Salmon and Garnier, Rousseau, Placet, Baldus, &c.; also the English labourers in the field—Talbot, Pouncey, Pretsch, Woodbury, Colonel Sir Henry James, &c.; but in a very important and profound discussion, the reporter, M. Davanne, the organ of the commission, the judge of the competition, proved that the palm was due to M. Poitevin, a man at the same time eminent and modest, who always aims in photography at arriving towards the perfection of unalterable proofs. It is true that M. Poitevin has been greatly aided by the co-operation of M. Lemercier, the celebrated lithographer, though he was equalled or exceeded since the closing of the competition by MM. Gainset, Baldus, Tessié de Mothay, and Maréchal de Metz, but the merit of his invention gives him the pre-eminence which the commission had so justly attributed to him. We may add that MM. Tessié de Mothay and Maréchal purchased the patents of M. Poitevin, taken out in 1855, for 400*l*. Less than a year ago he was obliged to support his family by accepting the humble situation of chemist in a small town, Ahun, in the department of the Creuse. Fortune has since favoured him.

Some months past a very ingenious man, M. Lavater, begged us to put him in communication with a skilful chemist or photographer who would help him to develope and bring to success an incompleted method for copying commercial letters and others by aid of a dry process. Every one understands what immense interest is attached to the subject of being able to reproduce a letter or manuscript by the simple application, with pressure, of a dry paper on the original. No one, we thought, could be better prepared on this subject than M. Nièpce de St. Victor for the solution of this difficult problem. So we sent M. Lavater to him. He set to work immediately, but without success; the dry method was continually unable to succeed, and it had to be laid aside for the present. The wet process, very troublesome and limited in its actual mode of application, gives only one copy—and a very imperfect one—of the writing to be reproduced. We are happy to learn that MM. Nièpce de St. Victor and Lavater have now substituted a method as easy as it is practicable, in the sense that it gives a great number of copies even after the original has been written for several weeks. The copying paper is to be slightly wetted with a sponge, and placed upon the original; it is then submitted to the vapour of a certain liquid easily procured; the writing on the copy, hardly visible, and at times quite invisible, appears at once fixed completely. The operation can be carried on the following days; and at a future period, not far distant, we shall give the composition of the developing fluid. It is necessary that this sort of ink should either contain gallic acid or logwood.

M. Claud Collas, a celebrated apothecary of the Rue Dauphine, continues his researches on the phosphates in general, and in particular the phosphate of lime, the powerful auxiliary of animal and vegetable life, and the activity of which continues in force even after death, but in a contrary sense. M. Collas has, in fact, demonstrated that the phosphate of lime becomes a decomposing agent of putrefaction, and after death hastens the dissolution it was the means of preventing during life; it also favours the development of new existences. Observation proves that in pregnant women or wetnurses there is an absence of phosphate of lime in the organism and the presence in the urine of sugar. The phosphate passes in a great part into the blood and into the milk, so as to serve for the consolidation of the bones of the infant, which are at birth in a cartilaginous state. M. Collas advises the following preparations :—1. *Solution of phosphate of soda*—namely, 8 grammes of phosphate in spring water. It is to be taken instead of mineral waters, mixed with wine, and at the

rate of two or three glasses per day. 2. *Phosphoric lemonade*—phosphoric acid 2 grammes in a litre of spring water, taken from time to time as a beverage. 3. *Hydrated phosphate of lime milk*—ordinary hydrated phosphate of lime 50 grammes, water 100 grammes, mixed together in a mortar, and then passed through a strainer or fine sieve; one, two, or three spoonfuls to be taken daily, especially in soup. This is the best way of administering phosphate of lime to rickety children. The phosphate of soda has the property of converting sugar into glucose in presence of carbonic acid. Cannot we attribute the viscous fermentations which sometimes appear in the distillations of beetroot juice to the presence in the juice of an excess of soluble phosphates and carbonic acid, in considering them as a first degree of disorganisation, caused partially by the phosphates?

A very ingenious young man, M. Maiche, jun., Rue Turenne No. 46, has made a considerable improvement in the manufacture of starch, which gives a greater return and will be necessarily adopted in all factories of that article. It consists in a new method of sifting the impure starches obtained by the known processes. If we take a sieve, the tissue of which is close enough not to let the grains of starch pass, these latter are deposited on the cloth of the sieve, and the sifting proceeds only drop by drop—that is to say, it is practically impossible. But if, instead of pouring upon the strainer the water charged with starch, we place the strainer on the water itself, agitating it by striking the edge, the starch passes upwards with the water, while the foreign substances remain at bottom. The mechanism for this purpose is composed of—1. A wooden case. 2. Another case of smaller diameter, the bottom of which consists of a layer of silk, and which is inserted into the former. 3. A ratchet wheel, the axle of which rests on two bearings fixed on the edge of the great tub. This wheel serves to give the sifting vessel a shaking or jumping motion. A tube of india-rubber conducts the impure starch into the tub. Another tube, siphon-shaped, takes off the water charged with starch which has passed through the sieve. Twenty-three kilogs. of impure starch give 20 kilogs. of pure starch, worth 16 fr., instead of 5 fr. 75 c. This gives, in favour of the new process, 51 fr. 25 c. per 100 kilogs. The process has been installed in a factory at Lurey, in the Haute-Saône, where it is expected to give from 10,000 to 20,000 fr. net profit.

F. Moigno.

THE PARIS EXHIBITION.

(From a Correspondent.)

Dirt, disorder, packing-cases, dust, and noise, reign supreme throughout the greater part of the building where those products specially interesting to your readers are located. It is quite impossible, and will be for many weeks to come, for me to send you any connected account of the chemical section. The English department is certainly nearer completion than the rest of the world; indeed, most of the cases are up and filled, but many of the most striking objects are covered over to protect them from the inevitable damage they would receive if exposed to the adverse influences which reign around.

I would not advise any of your readers to come here before the end of May, as it is quite impossible for the building to have put on its holiday attire before that time. It is true that the hot season will then be close upon us (and all *habitués* of Paris know what that means), but chemists are accustomed to furnace operations, and as the most gloomy imaginations have not predicted a higher temperature for the interior of the building than 50° C., your readers, especially those engaged in the glass and iron manufacture, will not feel this any detriment. Besides, have we not elaborate systems of ventilation, which are to be in full force, drawing the heated air out of one court into another, and wafting it about the building?

At present I cannot give an account of anything *seriatim*, but must content myself with picking up such novelties here and there as may be likely to interest you. Perhaps the most striking object in the metallurgical department, Class 40, is the magnificent case, the size of a small room, with its costly contents, exhibited by the firm of Johnson and Matthey, Hatton Garden, London. They show platinum stills and siphons capable of concentrating eight tons of oil of vitriol per day. These are remarkable in many respects. The metal of which they are made is said to be of chemical purity, and the joinings are not soldered together with gold, as in the usual way, but the two edges of the metal are actually melted together before the oxyhydrogen blowpipe, so that the whole apparatus consists of only one piece of metal. It is thus rendered much stronger, more durable, and cheaper than those made by the old plan. Amongst other articles of platinum in this case may be noticed ingots and bars of platinum fused by Deville and Debray's process; platinum alembics for use in parting gold and silver; platinum tubes, soldered by the autogenous process; platinum wire, sheet, foil, leaf, crucibles, capsules, sponge, granulated and native; touchholes for cannon made of fused alloy of platinum and iridium; one of those exhibited has been used in a Whitworth gun for more than 3000 rounds, and scarcely shows signs of wear yet. Those who know the constant trouble and expense which are occasioned by the wearing of the vent-pieces of cannon when in active service, will appreciate this important adaptation of Messrs. Johnson and Matthey.

One very important and instructive series exhibited by this enterprising firm is a collection of noble, rare, and common metals, of chemical purity, and cast into symmetrical form to illustrate practically their specific gravity and characteristic appearance in the fused state. The ingots weigh one kilogramme each, and consist of gold, silver, platinum, iridium, rhodium, palladium, lead, bismuth, copper, cadmium, cobalt, nickel, iron, antimony, zinc, magnesium, aluminium, thallium, sodium, and potassium. Besides these are osmium in the pulverulent state, and mercury. This series is in the highest degree instructive, and even those who are well acquainted in detail with the metals composing it, can have no idea of the vivid manner in which their properties of weight and colour impress themselves on the mind when presented in this eminently glyptic manner. The wonderful density of iridium and platinum is in striking contrast to the levity of magnesium, sodium, and potassium. I cannot help regretting that the series is not closed with lithium; the bar of this metal would have been upwards of three times the length of the magnesium. Thallium stands in about the centre of the series, being very close to palladium.

In addition to the masses of platinum, this firm exhibits an accurate model of the enormous ingot of platinum, weighing 100 kilogrammes, or one-eighth of a ton, which attracted so much attention in 1862.

The value of the precious metals shown by Messrs. Johnson and Matthey is about half a million francs.

The same firm also exhibits specimens of sodium amalgam, which is now so largely used for the extraction of gold from its ore. The results of carefully conducted experiments are shown side by side. They are truly astonishing. The mineral chosen was a composite Californian one, which had been found very difficult to work by the ordinary process. The results obtained by Messrs. Johnson and Matthey were the following:—

	Grammes.	Ounces.	Dwts.	Grs.	
Product by the ordinary method of amalgamation	87 =	2	16	0	per ton.
Product by the sodium process of Mr. Crookes	218 =	7	0	6	,,
Given by assay	232 =	7	9	0	,,

The experiments were twice repeated, and the results were absolutely identical. It is not unlikely that later in the season an opportunity will be given of illustrating the advantages of this process on a large scale in one of the laboratories in the adjacent park.

Among the great industrial inventions shown in another part of the building I may remark the process by which M. Mond, a chemist of Utrecht, extracts sulphur from soda waste without removing it from the vessels containing it. This process consists in forcing a current of air into the waste in order to oxidise it, after which a stream of water is directed upon it so as to lixiviate it. The mixture is then subjected to another similar treatment, so as to concentrate it, after an interval which varies from sixty to seventy-two hours. In order that the sulphur may be regenerated as much as possible, the oxidation must be regulated so that the liquors contain two equivalents of sulphide of calcium for one of hyposulphite of soda. The solution is then transferred to vessels either of wood or refractory brick, and an equivalent of chlorhydric acid is added. The sulphur is at once precipitated in a state of purity, without any perceptible disengagement of sulphuretted hydrogen gas or sulphurous acid. If, instead of chlorhydric acid, the residues of the chemical works for the fabrication of chlorine (a mixture of chloride of magnesium, perchloride of iron, chlorhydric acid, and free chlorine), the oxidation of the liquors may be so modified that they contain very little hyposulphite. He also adds a peculiar preparation to the mixture above described, in necessary and sufficient proportions to neutralise the free chlorhydric acid and reduce the protochloride and perchloride of iron. A precipitate is thus obtained containing 95 per cent. of sulphur. In chemical works in which chlorhydric acid is advantageously employed, the lixivia are superoxidised, so that they contain enough hyposulphite to be easily separated into sulphur and sulphate with very little sulphurous acid. The sulphur thus obtained is mixed in a quantity less than a third with sulphate of lime, and should be purified. Treated by this process the soda waste contains very little sulphide, but much carbonate and sulphate of lime. Far from being injurious, the latter are very serviceable as ingredients of chemical manures. The expense is inconsiderable, the cost of the apparatus being covered by the first year's crop, and the net profit of the regeneration, and for an establishment producing 3 tons of soda per day, will be at least 400*l.* per annum.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, April 4.

WARREN DE LA RUE, *Esq., Ph.D., F.R.S., President, in the Chair.*

THE minutes of the anniversary meeting and of the last ordinary meeting were read and confirmed, and several donations to the library were announced. Messrs. F. S. Barff, M.A., and Alfred Tribe were formally admitted Fellows of the Society, and the following gentlemen were duly elected—viz., Mr. John Mackay, 119, George Street, Edinburgh, and Mr. David Skinner Kemp, Bombay. For the second time were read the names of Alfred Coleman, Plough Court, Lombard Street, and William Phipson Beale, barrister-at-law, Stone Buildings, Lincoln's Inn. The candidates proposed were William Gowland and George Robert Gowland, both of 48, High Street, Sheffield; John C. Brough, journalist, 4, Norman Terrace, Stockwell; Edward Packard, Jun., manufacturing agricultural chemist, Ipswich; F. W. Peterson, of her Majesty's Mint, Calcutta, 51, Myddelton Square, London.

Dr. J. H. GLADSTONE made a short statement respecting the "solidified glycerine" which was exhibited by Dr. W. S. Squire on a recent occasion. It was then said to be a task of great difficulty to procure again the white crystals from a liquefied portion of the substance in question, but the speaker did not find it to be so, for a sample which Dr. Squire kindly permitted him to take from that shown at the meeting a fortnight since was placed (in a bottle) on a warm mantelpiece, where it soon became perfectly fluid, but on being removed only to another part of the room, the crystals were formed again in it the next morning. Snow had fallen during the night, but the frost was by no means severe, and even now, after a week of mild weather, a portion of the glycerine was yet solid. (The bottle, with its contents partly crystallised, was handed round for inspection.)

A paper, entitled "*Experiments on Oxidation by means of Charcoal*," by Dr. F. CRACE CALVERT, was read by the SECRETARY. After referring to the early experiments of Theodore de Saussure, and those of ten years ago by Dr. Stenhouse, the author proceeded to inquire into the *modus operandi* of the absorption of gases by charcoal—whether, for instance, in the case of ammonia, this substance existed unchanged, but in a state of great condensation, within the pores of the charcoal; or whether it underwent oxidation, and so became destroyed by the exalted affinities of the oxygen or air compressed within the charcoal. This problem is not solved, but the author considers that there is evidence of the destruction of ammonia when this gas is mixed with oxygen and placed in contact with charcoal, but whether nitric acid is formed, or only nitrogen and water, is left open to further investigation. Sulphurous acid and gaseous sulphide of hydrogen were very soon oxidised, and converted into sulphuric acid; so also phosphoretted hydrogen quickly became phosphoric acid. Alcohol vapour diffused in oxygen was changed into acetic acid, and methylic alcohol is believed to be converted into formic acid. Amylic alcohol furnished valerianic acid. Ethylene, propylene, and amylene were then experimented upon in a similar manner; all of them produced carbonic acid and certain residual oxides, but the latter were not distinctly identified. The author concludes by advancing a speculation to account for the phenomena observed by him, and suggests that possibly the condensation of oxygen and other gases by charcoal amounts to an actual liquefaction within its pores, and by thus being brought into closer contact, the bodies are respectively placed within the sphere of each other's attraction, and a chemical change occurs accordingly.

The PRESIDENT, in moving a vote of thanks, referred to the difficulty sometimes encountered in accurately defining the physical condition of bodies; thus, in the operation of coining, and particularly in the manufacture of tin capsules, the solid metal behaved almost like a fluid substance, and the particles appeared so mobile that they might almost be compared to a veritable liquid. At an early hour the President suggested an adjournment for the purpose of enabling the Fellows to attend the meeting of the Royal Society, at which a paper of great chemical interest, "*On the Stability of Gun-cotton*," by Mr. F. A. Abel, was then being read.

PHARMACEUTICAL SOCIETY.

April 3, 1867.

G. W. SANDFORD, *Esq., President, in the Chair.*

MR. HANBURY laid several botanical specimens on the table for the Society to select any they might wish to have for the museum.

Mr. A. F. HASELDEN, before continuing his paper "*On the Codex and the British Pharmacopœia* (1864) *Compared*," said there was a slight error on the title-page of the *Journal*; instead of the British Pharmacopœia, 1867, it should have been 1864. At the last meeting the author said that he had undertaken a work of no small labour

and magnitude, and in one paper he knew it to be impossible to go fully into the subject, but his desire was first to notice the report and preface, and then to take each part separately and point out any difference he thought worthy of notice between the Codex and the British Pharmacopœia. The work contains a report to the Emperor, a preface, preliminary remarks, Materia Medica, and the Pharmacopœia. Under preliminary remarks, weights and measures are noticed. As it is now compulsory in France to use, in weighing or measuring, the decimal-metric system, the Codex contains four tables relating to weights, the only measure in use being the litre and the decimal divisions thereof. The author then referred to the table which is given in the Codex, showing the value by weight of spoonfuls, glassfuls, handfuls, and pinches, remarking that the British Pharmacopœia contained no such table, and that it would be to us a retrograde movement, pinches and handfuls being only employed in the kitchen. For certain liquids the compilers of the Codex have recommended the use of a *compte-gouttes*, which consists of a globular glass bottle with a lateral tube, the interior diameter adjusted so as to allow a liquid to flow drop by drop. Mr. Haselden showed various kinds of drop measures which had been invented, but he could measure as accurately and quickly as necessary with the minim measure. The *compte-gouttes* might be useful to patients taking any particular medicine by drops, but the system of drops, either in prescribing or administering medicines, should be discontinued, prescribers writing minims instead of drops, and administering nothing less than a teaspoonful. The author then referred to that part of the Codex relating to densities and areometers or hydrometers, saying that Beaumé's was the one directed to be used. He then passed on to the Materia Medica, the first section of which comprises those substances which are obtained either from the vegetable or animal kingdom. Amongst the animals named were the vine-snail, cellar-woodlouse, viper, frogs, &c. The author pointed out that in both books the arrangement is alphabetical. The Codex contains nearly double the number of substances that are in the British Pharmacopœia. In the Codex the common name is given in French, the botanical in Latin, the order or sub-order and the part to be used in French. Mr. Haselden then proceeded to notice some of the substances contained in the Materia Medica, comparing them with the British Pharmacopœia. The root and leaf of aconite are employed, but, as the root is more active than the leaf, the pharmaceutist is directed to use the preparations from the leaves if the tincture or extract of the root is not specified. Three kinds of aloes are named, the preference being given to Cape. The root and leaves of belladonna are directed to be employed, but nothing is said about the state of the leaf. Mr. Haselden showed some specimens of benzoin, dried jujubes, &c., and noticed catechu, cascarilla, colchicum, coriander, cubebs, hyoscyamus, taraxacum, &c. He concluded his paper by saying that if his friends had not given him the opportunity of spending a short time in France and acquiring a knowledge of the French language he would not have had the pleasure of meeting them that evening to notice the differences between the two Pharmacopœias.

Mr. Joseph Ince read a paper "*On the Theory of the Universal Codex*," in which he stated that he believed it was perfectly impossible to assimilate the whole of the Pharmacopœias. The British Pharmacopœia was specifically English; viewed in every light it was British; and the Codex was a French book only adapted to the French people. Mr. Ince referred to some of the preparations to show how useless they would be in other parts of the world. In concluding his paper, he advocated the decimal-metric system of weights and measures, and regretted that the Pharmacopœias were not written in Latin.

Dr. Farre fully endorsed every word Mr. Ince had said. It was found very difficult to construct the British Pharmacopœia, and he believed it would be impossible to construct a universal Pharmacopœia.

Dr. Attfield thought it quite possible to form a basis for a universal Pharmacopœia. He hoped they would be able to discuss the subject at the Paris conference in August.

Mr. Squire wished to direct attention to a rule adopted in the Codex which he thought was a step in the right direction. The strength of the tinctures in most cases was one in five or one in ten, while in the British they differed very much.

Dr. Redwood thought the subject of constructing a universal Pharmacopœia worthy of consideration. The Indian Pharmacopœia had hitherto very much resembled the London Pharmacopœia. He was aware that a new one was in preparation, and he would like to hear from Mr. Hanbury, who, he believed, was engaged in the work, in what points it would differ from the former editions.

Mr. Hanbury said the new Indian Pharmacopœia would contain all the medicinal plants, &c., found in India; it would partake more of the character of a dispensatory, and was intended to be used as a text-book in the Medical Colleges. With regard to Mr. Ince's paper, Mr. Hanbury thought it not impossible to assimilate the Pharmacopœias; there would be far less difficulty with the German Pharmacopœia than the French Codex. Since 1788 our own Pharmacopœia had gradually become more simple.

Mr. Deane drew the attention of the meeting to a new stove for pharmaceutical purposes, which he had found more useful than the pharmaceutical stoves in general use.

The Chairman announced that this was the last meeting of the session. He thanked those gentlemen who had favoured them with papers, and said that a *conversazione* would take place on May 14.

ACADEMY OF SCIENCES.

April 8, 1867.

(From our own Correspondent.)

M. Dupré, of Rennes, presented the description of a machine by the aid of which he makes, without integration, the calculations relative to different applications of the mechanic theory of heat.

M. Chevreul announced the distribution of the twenty-ninth volume of the *Mémoires* of the Academy, wholly occupied with M. Delaunay's theory of the moon.

M. de Quatrefages presented the volume entitled "The Seasons, Studies of Nature," which M. Ferdinand Hoefer has just published through Hachette and Co.

M. Velpeau presented, in the name of the celebrated surgeon, M. Simpson, the description of his steel-suture process, with numerous observations, and operations crowned with complete success. This process, which advantageously replaces the caustic of the ancients or the ligature of Ambrose Paré, consists in implanting under the artery, in contact with it, a needle, on which it presses sufficiently to stop the pulsations.

M. Dumas announced the news of the production, artificially, by M. Wurtz, of a considerable number of alcohols from the series creosote, phenol, &c. M. Wurtz treats the substances—carbolic acid, for example—first by anhydrous sulphuric acid; potash does not then regenerate the body, but it gives rise to the corresponding alcohol, creosote, or phenol. The celebrated Belgian chemist, M. Kékulé, has succeeded in obtaining similar reactions, which he will shortly publish.

We recommend to our readers the interesting and courageous work that Dr. Blutin has published through Hachette and Co., entitled "Our Cruelties towards Animals, to the Detriment of Health, Public Prosperity, and Morality."

M. Marié Davy requested the examination by a commission of a memoir on the electrometric force, which he measures by the aid of a thermometric heating apparatus of particular form.

NOTICES OF BOOKS.

An Essay on Dew, and several Appearances connected with it. By William Charles Wells. Edited, with Annotations, by L. P. Casella, F.R.A.S.; and an Appendix by R. Strachan, F.M.S. London. 1866.

We think Mr. Casella has rendered good service to scientific literature by the republication of Dr. Wells's celebrated essay, which has been out of print during upwards of forty years. This essay has been praised in such very high terms by Sir John Herschel, John Stuart Mill, and other writers down to our own day, that access to the work is desirable on many grounds. Mr. Casella repeats the substance of the praise in his own words:—"The essay, as a literary production, is a model worthy the attentive study of scientific experimentalists and students" (p. iii.); and yet at p. v. it is admitted that "all the main facts and features of the theory were known beforehand;" and further, "that he (Wells) insufficiently acknowledged the labours of his predecessors may be admitted." Is it meant that when the student writes a paper on his own account, and takes this essay as his model, he is not to acknowledge the labours of his predecessors?

The fact is, there are two classes of scientific men—namely, *workers* and *writers*—and the two are not often combined. The worker, in writing his own memoir, is generally too intent on his own share in discovery to do more than accept the conditions of the question in hand from some writer who himself may perhaps have compiled from earlier books, and not have taken the trouble to consult original memoirs. There are not many writers who work at scientific literature with the same zeal with which literary men pursue their labours, and the reason is to be found in the marked difference between literature and science. A literary work bears the impress of *mind;* a scientific work bears the stamp of *nature*. The one is individual and proper to the man; the other is general and has no individuality. A work by Shakspeare remains for all time untouched, unchanged; a work by Davy may be taken up by Faraday, and Faraday's work may be carried on by any number of his contemporaries or successors. And this is probably what Lord Bacon meant when he said that his method of philosophising tended rather "to level wit and intellect." "For as in the drawing of a straight line or accurate circle by the hand, much depends on its steadiness and practice; but if a ruler or compass be employed, there is little occasion for either; so it is with our method." It is on account of this absence of individuality in scientific writing that we have so few good scientific writers. Our scientific style is often slovenly, or, what is worse, is afflicted with that vice of inexperience—namely, *fine writing*. And here we may refer with admiration to the charming simplicity of style in Dr. Wells's essay, and in this respect we certainly admit that it deserves to be a model. The scientific writing of the French deserves similar praise, but the French have a better scientific training than we can give; moreover, they are more logical than we; they are proud of their language, and more critical in the use of it.

The interest that is felt in literary history, as compared with the comparative want of interest in scientific history, rests on the fact that a Chaucer, a Shakspeare, a Dryden, a Gibbon, is each an intellect rounded, complete, and final. But, without meaning the slightest disrespect to such great men as Newton, Davy, Faraday, it must be admitted that they are but parts of a great whole, and that whole is Nature. We care more about the laws of nature than about their discoverers; but every one feels an interest in a great writer, because he and his works are inseparably connected. An unpublished letter by Goldsmith, a few unpublished lines by Dryden or Pope, would excite the ardour of our whole literary world. A new fact in the history of oxygen, or of the composition of water, would fail to receive more than a passing glance from scientific men. They consider that all the main facts are embodied in text-books, handbooks, and other treatises, while that which is not embodied is of no consequence. They consider that we have the discoverers and the dates of all important facts, in the main, correct. They want to pursue discovery, not its history, and hence they feel but little interest in the light thrown by old memoirs on the progress of the past.

When, however, we meet with a writer like Dr. Whewell, who knows his business and gets a true impression by tracing the history of a theory or of a discovery down to the time when it receives its last touches, we accept, or ought to accept, his judgment with more respect than that of the most original mind and most brilliant discoverer who has not gone over the historical evidence. Sir John Herschel speaks of Wells's essay "as one of the most beautiful specimens of inductive experimental inquiry," and earnestly recommends it to the student "as a model with which he will do well to become familiar." Dr. Whewell simply characterises Wells's essay as "one of those books which most drew attention to the true doctrine." (See "History of the Inductive Sciences," 3rd ed., 1857, vol. ii. p. 424; see also p. 415.)

Even during the lifetime of the author the essay did not pass unchallenged. Dr. Thomas Young, both a writer and a worker, noticed the book in the *Quarterly Review* for 1814, and says, with bitter satire, that while Dr. Wells "affords us complete information, not only respecting the sentiments of Aristotle and Theophrastus as to the nature and causes of dew, but also of the most distinguished philosophers of modern times, some of the works, however, of the persons whom he mentions, and some of the latest, have most unaccountably escaped his attention." Dr. Young protests against "the total novelty of the opinions, &c.," in the essay.

The reader interested in the subject will find in a little shilling volume published in Weale's series, entitled "Experimental Essays," by Mr. Tomlinson, a minute account of what had been done by Wells's predecessors. Mr. Casella has made free use of Mr. Tomlinson's essay, but, as it seems to us, only so far as it refers to the praise and glory of Wells, omitting all detail that might cast a spot on that bright surface. The language of Wells's essay is that of authority. The writer's tone is everywhere that of a man announcing his own discoveries. For example, he says:—"I have frequently seen, during nights that were generally clear, a thermometer lying on the grass plat rise several degrees upon the zenith being occupied only a few minutes by a cloud." Most of the important steps in the theory are thus stated, as if for the first time; and we agree with Mr. Tomlinson that in the essay "we find only a loose and general reference to authorities, and a very scanty acknowledgment of other men's labours." Nevertheless, "most of Wells's results had been published long before the author commenced his labours, and the theory for which he has obtained so much credit was also similarly indicated in brief but unmistakable terms."

While grateful for a reprint of Wells's essay, we fear the praise bestowed on this edition must be similar to that of the lady on the curate, whose copied sermon she praised, and the only merit he claimed was that of having delivered it. "Ah! that is the only part about it I didn't like." We like Wells's essay, but we do not like the way in which it is "delivered." The book is scarcely improved by the additions. Unless the work had been more thoroughly done, a simple reprint of the edition of 1818, with the short autobiography by way of introduction, would have answered every purpose for which this edition is issued.

In a work that professes to bring the subject down to the present time, it is remarkable that some celebrated researches are unnoticed. Such are Melloni's "On the Nocturnal Cooling of Bodies." The experiments were

conducted in the autumn of 1846, in the valley of La Lava, between Naples and Salerno, and the memoirs, which are beautifully written and of great interest, were read before the Royal Academy of Naples in February and March, 1847. But the most curious point connected with this inquiry is its origin. It will hardly be believed that the Austrian and Bourbon Governments, in their dread of novelty, would not allow the true theory of dew to be taught. Melloni, in order to show that the laws of terrestrial radiation are the same in Italy as in countries where there is more political liberty, undertook these researches. The care with which he prepared his thermometers for observation is worthy the attention of meteorologists.

CONTEMPORARY SCIENTIFIC PRESS.

Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Journal des Fabricants de Papier. December 15, 1866.

E. Bourdilliat "*On the Chemical Products used in Paper-making.*"

January 1, 1867.—E. Bourdilliat "*On Testing the Chemical Products used in Paper-making.*"—Lepelletier: "*An Economical Method of Treating the Materials used for the Manufacture of Paper.*"—Peyron and Michaud: "*A Method of, and Apparatus for, Preparing Wood and other Vegetable Matters for the Manufacture of White Paper.*"

January 15.—E. Bourdilliat "*On Testing the Chemical Products used in Paper-making.*"—"*On the French Police Regulations affecting the Sale of Papers covered with Lead Glaze.*"

February 1.—E. Bourdilliat "*On Testing the Chemical Products used in Paper-making.*"—C. R. Maréchal and T. du Motay "*On Bleaching Animal and Vegetable Fibres and Tissues.*"

Technologiste. January, 1867.

J. Fuchs "*On the Preparation of Metals and Alloys in Powder.*"—C. Stahlschmidt: "*Experiments on the Reducing Properties of Zinc.*"—J. C. Fischer: "*Historical and Practical Researches on the Nature of Purple of Cassius.*"—H. Vohl "*On the Extraction of Oil from Seeds.*"—P. Bolley "*On the Colouring Matter of Garancine.*"—Crinsoz "*On the Presence of a Yellow Crystalline Colouring Matter in Indigo.*"—E. K. Senefelder: "*Indelible Ink.*"

L'Invention. January, 1867.

P. Alfraise: "*Specifications of Patents relating to Aniline.*"—Nézereaux "*On the Methods of Covering Electrotype Moulds with a Conducting Medium.*"—"*On a Method of Distinguishing Silk from Woollen Threads.*"—Gaade: "*An Improved Decolorising Compound.*"—Baron-Chartier: "*An Improved Manure for Destroying Insects.*"—Mançais: "*A Method of Treating Substances containing Tin.*"—Page: "*Improvements in Tanning and Currying Leather.*"—Périer "*On the Purification of Saccharine Juices.*"

February.—Sevez "*On the Use of Aniline Green for Printing Fabrics.*"—"*On the Utilisation of the Residues produced during the Manufacture of Aniline, and on Obtaining spent Arsenic Acid from such Residues.*"—Cotelle "*On the Utilisation of Chlorine Residues.*"

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

458. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the application of certain hydrocarbons to the obtainment of light and heat, and in the apparatus or means employed therein." A communication from A. Muller and J. Matheï, Paris.—Petition recorded February 20, 1867.

563. A. A. Croll, Coleman Street, London, "Improvements in the treatment of liquid hydrocarbons for the purpose of obtaining a permanent gas."—February 28, 1867.

579. W. Parry and J. Frearson, Birmingham, "Improvements in treating or purifying sewage, and in apparatus to be used for that purpose."—March 1, 1867.

605. S. Newington, Ticehurst, Sussex, "An improved compound for destroying insects and preventing and checking blight in plants."—March 4, 1867.

611. A. S. Macrae, Liverpool, "Improvements in hydrocarbon oils used for safety and other lamps."

616. J. E. Duyck, Glasgow, N.B., "Improvements in the utilisation of mineral and other oils for the production of heat, and in the apparatus employed therefor."—March 5, 1867.

624. J. Thompson, Nettlebed, Oxfordshire, "Improvements in the manufacture of gas."—March 6, 1867.

647. E. Lloyd, Bow, Middlesex, "Improvements in the treatment or preparation of straw and other fibrous materials for the manufacture of paper."

650. W. Young, Straiton, Midlothian, and P. Brash, Leith, Midlothian, "Improvements in the distillation of bituminous substances."

652. S. C. Salisbury, New York, U.S.A., "Improvements in the manner of reducing aud refining metallic ores, more particularly ores of iron, and in converting iron into steel, and in apparatus to be used in connexion therewith."—March 7, 1867.

657. J. Turner, Queen Street, Stepney, Middlesex, "An improved composition for coating or covering the surface of iron, wood, stone, brickwork, and other substances or materials to prevent oxidation and decomposition thereof."—March 8, 1867.

Notices to Proceed.

2886. W. Darlow, Tottenham, Middlesex, and P. W. Seymour, Canning Town, Essex, "A new magnetic compound applicable to the manufacture of articles suitable for curative and other beneficial and useful purposes."—Petition recorded November 7, 1866.

2947. G. Crawshay, Gateshead-on-Tyne, Durham, and J. Thomas, Newcastle-on-Tyne, "Improvements in the treatment of scoria or slag of copper ores, or scoria from other ores containing iron, in order to extract the iron therefrom, and in refining pig or cast iron to improve the quality of wrought or cast iron."

2948. G. Crawshay, Gateshead-on-Tyne, Durham, and J. Thomas, Newcastle-on-Tyne, "Improvements in refining pig or cast iron for puddling into wrought or malleable iron."—November 10, 1866.

2957. G. Crawshay, Gateshead-on-Tyne, Durham, and J. Thomas, Newcastle-on-Tyne, "Improvements in the treatment of titaniferous iron ores, and in extracting iron therefrom; also for utilising the scoria produced."—November 12, 1866.

3002. W. Grüne, Berlin, "A chemical decoration on gold, silver, and other metals, and colours on porcelain, glass wares, crystal wares, Delft wares, potters' wares, and similar matters, called 'Grüne's process.'"—November 15, 1866.

3030. A. P. Price, Lincoln's Inn Fields, Middlesex, "Improvements in the manufacture of carbonate of soda." A communication from Dr. A. Blügel, Utrecht, Holland.—November 19, 1866.

3066. P. R. M. Le Guen, Rue Voltaire, Brest, Finistère, France, "An improved process for combining tungsten with cast iron, by conglomerating reduced wolfram."—November 22, 1866.

3133. W. R. Lake, Southampton Buildings, Chancery Lane, "Improvements in the manufacture of white lead."

A communication from W. Bell, T. M. Fell, and A. G. Fell, New York, U.S.A.—November 28, 1866.

3112. N. S. Shaler, Cambridge, Mass., U.S.A., "Improvements in preserving animal and vegetable substances."—November 26, 1866.

3152. W. Clark, Chancery Lane, "Improvements in the manufacture of green colouring matter." A communication from J. A. Schlumberger, Boulevart St. Martin, Paris.—November 30, 1866.

3212. P. E. Wissocq, Rue Richepanse, Paris, and Count L. Krasinski, Rue de Penthièvre, Paris, "Improvements in the treatment of ores of metals of which the sulphates are soluble in water."—December 6, 1866.

425. J. Lamble, Southampton, Hants, "A new or improved composition for the coating and preservation of ships' bottoms."—February 15, 1867.

471. H. Wadkin and C. Shepherd, Chester, "Improvements in burning or calcining limestone and cement, and in ovens or apparatus employed for that purpose."—February 21, 1867.

560. S. B. Allen and J. H. Winsor, Massachusetts, U.S.A., "Generating heat by the admixture and combustion of a hydrocarbon vapour, air, and the gaseous components of steam." A communication from H. R. Foote, Boston, Suffolk, Mass., U.S.A.—February 28, 1867.

651. W. H. Towers, New York, U.S.A., "A new and useful process whereby leather, wholly or partially tanned, or animal tissue of any nature, is made hard, semi-elastic, and transparent, and rendered a fit material from which to manufacture combs, buttons, buckles, eye-glass frames, splints, knife-handles, articles of jewellery, and other articles now produced from vulcanised india-rubber."—March 7, 1867.

CORRESPONDENCE.

Decolorising Green Bottle-Glass.

To the Editor of the Chemical News.

Sir,—In reference to your Siberian correspondent's inquiry on the above subject in your last issue, I beg to say that I have used, on a large manufacturing scale, with much success, arseniate of soda, or a mixture of white arsenic, soda ash, and nitrate of soda, for decolorising silicate of soda made from sulphate of soda, silica, and coal.

I am, &c. B.A., B.Sc.

April 3.

Eudiometric Analysis of Ammonia.

To the Editor of the Chemical News.

Sir,—Not a few, doubtless, of the readers of your valuable periodical are chemical lecturers interested in the effective experimental demonstration of the volume composition of Gerhardt's types. This seems evidenced by your publication of Dr. Hofmann's lecture illustrations in vol. xii., and by the large sale of that Professor's "Introduction to Modern Chemistry," in which the same are detailed.

Suffer me, then, to mention, as a modification of these experiments, that the volume composition of ammonia may be readily shown by explosion with oxygen in the eudiometer, thus enabling the teacher to assimilate the mode of investigation of this type to that of H_2O and HCl, and to dispense with a tedious quantitative operation—viz., the decomposition of liquor ammoniæ by a measured bulk of chlorine.

The few precautions are sufficiently obvious—viz., first, to use a considerable excess of oxygen to mitigate the otherwise violent detonation; secondly, to previously dry the eudiometer and gases, both to avoid absorption of the NH_3 and to remove, as far as possible, the additional expansive force of the steam generated at the moment of ignition.

The following are the numbers of a rough experiment at the lecture table, which followed, in order, Hofmann's illustration, Fig. 11, p. 56, vol. xii. Chemical News, proving the condensation of the ammonia molecule to be ½, and which replaced that previously explained by him, Figs. 8 9, 10, on the preceding page:—

Analysis of Ammonia.

Volume of	dry ammonia	86	c.c.
,,	ditto, supposed resolved into its elements	172	,,
,,	oxygen added	126	,,
,,	sum of H, of N, and of O	298	,,
,,	after explosion	105	,,
,,	diminution	193	,,
,,	hydrogen = ⅔ of loss	128·6	,,
,,	nitrogen (by subtraction)	43·4	,,

A result closely conformable with the prediction of the formula NH_3.

It appears, consequently, that, by using these proportions of the gases, the production of oxides of nitrogen is inconsiderable.

I am, &c.

B. W. Gibsone, F.C.S.

City of London College, March 25.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Reduction of Organic Compounds.—M. Berthelot. Researches commenced by Berthelot, in 1855, on the use of iodhydric acid as a reducing agent, and continued until now, and results obtained by other investigators, have furnished sufficient materials for constructing a general method of reduction, which is fully developed in this paper, to which the reader must be referred for details. The author considers that the facts described furnish a general method for the reproduction of the fundamental hydrocarbon from any of the bodies composing the carbon series, of which it is the basis. In this respect incomplete compounds behave like complete ones, the first action of the iodhydric acid being to convert the former into the latter. The remarkable facility with which iodhydric acid parts with its hydrogen under the conditions of the experiments described, appears to result from the operation of thermochemical laws. The quantity of heat disengaged on the formation of one equivalent of iodhydric acid from iodine and hydrogen may be estimated at 1400 units, whilst the formation of bromhydric acid sets free 13,200 units, and that of chlorhydric acid 23,800 units. A glance at these figures enables us to understand why iodhydric is very much less stable than either bromhydric or chlorhydric acid, and that the slightest change in the state of the body in presence of iodhydric acid may establish a reaction by furnishing the small amount of energy necessary for the decomposition of the acid. Moreover, at 275°, the temperature at which the normal reactions occur, iodhydric acid is in so unstable a condition of equilibrium, that it begins to decompose spontaneously.—(*Bull. Soc. Chim. Paris*, 1867, 53.)

Nitriles.—L. Henry. Acetonitrile combines, with disengagement of heat, with dry bromhydric and iodhydric acids. The resulting compounds are crystalline white solids, deliquescent, soluble in alcohol, insoluble in ether, decomposing rapidly in moist air, with formation of acetic acid and ammonic salts. Caustic alkalis effect the analogous change; the corresponding compound with chlorhydric acid it is difficult, that with cyanhydric acid apparently impossible, to obtain. Acetonitrile also combines with silicic chloride.

Benzonitrile, which is best prepared by phosphoric pentachloride and benzamide, behaves, under similar conditions, like acetonitrile.

Ethylic and allylic sulphocyanides combine with dry bromhydric and iodhydric acids, but allylic sulphocyanide appears not to combine with chlorhydric acid.

Acetylic bromide forms a crystalline compound with acetonitrile and with allylic sulphocyanide.—(*Bull. Soc. Chim. Paris*, 1867, 85.)

Naphthalene (C=6).—E. J. Maumené. The theory of chemical action propounded by the author has conducted him to the discovery of several new hydrocarbons. Naphthalene heated with argentic oxide to 250°, or with cupric oxide to 400°, or even to a dark red, gives, even though a great excess of oxide be employed, various bodies all magnificently crystalline, among which are *nonolène* $C_{18}H_8$ ($\frac{1}{2}$ chrysene), *octojiène* $C_{16}H_6$ (dracene), *hexahène* $C_{12}H_4$. Full details are promised.—(*Bull. Soc. Chim. Paris*, 1867, 72.)

Nomenclature of Hydrocarbons (C=6).—E. J. Maumené. It is proposed that the names of all hydrocarbons terminate in -ene; also—(1) considering C_2H_2 as a molecular unit, that in the series $C_{2n}H_{2n}$ the value of n be expressed by the words mono-, di-, &c.; (2) that in the series $C_{2n}H_{2n-x}$, in which carbon predominates, the letter of the alphabet corresponding by its numerical order to the value of x be interposed between the words mono-, di-, &c., and the general termination -ene; (3) that in the series $C_{2n}H_{2n+x}$, in which hydrogen predominates, the particle hydro-, coupled with the letter expressing, as in (2), the value of x, be interposed between the words mono-, di-, &c., and the general termination -ene. To give an idea of the names so constructed, the following are selected from the fourteen groups given in detail by the author:—$C_{2n}H_{2n+2}$ marsh gas, C_2H_4 monohydrobene; $C_{2n}H_{2n+1}$ ethyl, C_4H_5 dihydrene; $C_{2n}H_{2n}$ ethylene, C_4H_4 diene; $C_{2n}H_{2n-1}$ allyl, C_8H_5 triaene. Polymers are expressed by using indices: thus, for polymers of phenyl, $C_{12}H_5$ hexagene, $(C_{12}H_5)^2$ hexagene^2, $(C_{12}H_5)^3$ hexagene^3. Compounds of two hydrocarbons, as allyl-phenyl, become triaene-hexagene. A table of the general composition of hydrocarbons, giving the proportions between (1) the number of equivalents, (2) the equivalent weights, (3) the simple weights, for each hydrocarbon, and which the author believes to be pregnant with interest, concludes the paper.—(*Bull. Soc. Chim. Paris*, 1867, 73.)

Aromatic Compounds, Reduction of (C=12, O=16).—A. Baeyer. Phenol vapour is reduced by hot zinc powder to benzol and some other bodies, among which is, perhaps, phenyl-ether. Benzoic and phtalic acids give bitter almond oil. Oxindol C_8H_7NO (*Zeitschr. Chem.*, N.F., ii. 685) gives indol C_8H_7N, resembling naphthylamine in properties, distilling at a high temperature, condensing to an oil, and presently crystallising. A pine-wood splinter moistened with chlorhydric acid and indol becomes cherry-red.—(*Zeitschr. Chem.*, N.F., iii. 90.)

Saline Solutions, Relative Volumes of.—J. Regnauld. The tabulated results accompanying this paper show that aqueous solutions of ammonia and of potash and soda behave differently when mixed with acids; the first shows a contraction, the second and third an expansion, yet in each case much heat is evolved. The change of volume is of the same sign, whatever be the nature of the acid used. The amount of change of volume for the same base depends on the acid saturating it. Potash and soda differ very little in these respects. Ethylamine and nicotine behave like ammonia—that is to say, they contract in uniting with acids. Lithia, baryta, lime, thallia, and tetrethylammonic hydrate belong to the potash and soda series—that is to say, they expand in uniting with acids.

The explanation of these phenomena is this: Ammonia dissolves in water, but does not combine with it to form a compound of any appreciable degree of stability. Contraction normally accompanies the production of ammonic salts. Potash and soda form very stable hydrates, which, in presence of acids, interchange with them. The elements of the salt formed contract in combining, and the water set free from the hydrates expands in escaping. The difference between the results of these two phenomena distinguishes the ammonia from the potash type.—(*Journ. Pharm. Chim.* [4] v. 81.)

Gum, Bleaching of.—Picciotto. Dissolve gum in 6—15 parts of water, filter through a cloth; with the filtrate mix recently precipitated alumina, and filter again. The alumina may be used twice; it may also be revived by washing with hot water, treating with chloride of lime or chlorine water, and washing with boiling water.—(*Polyt. Notizbl.*, 1865, 282.)

Cetene, Derivatives of (C = 12, O = 16).—J. J. Chydenius. Cetene, $C_{16}H_{32}$, prepared from cetylic alcohol and phosphoric anhyride, combines eagerly with bromine, forming $C_{16}H_{32}Br_2$, a yellowish liquid heavier than water, which decomposes if distilled, even though *in vacuo*, and, if treated with alcoholic solution of potash, gives $C_{16}H_{31}Br$, a yellow liquid lighter than water. Cetene combines with chlorine, but the results are not described, being difficult of preparation. Monobromcetene distilled with lime or sodic ethylate gives cetylene, $C_{16}H_{30}$, the highest known homologue of acetylene, colourless, oily, lighter than water, distilling undecomposed, melting at −25°, boiling at 280—285°, easily soluble in alcohol and ether, combining with Br_2 to form a yellow liquid heavier than water, very easily attacked by alcoholic solution of potash with reproduction of cetene. An attempt to prepare the diatomic alcohol failed.—(*Comptes R.* lxiv. 180.)

Pseudomorphine (C=6, O=8).—O. Hesse. From the small quantity he obtained, Pelletier, who discovered pseudomorphine thirty years ago, was unable to give precise directions for its preparation, and naturally enough doubt fell on its identity. Hesse finds that it accompanies morphine in Gregory's method, and may be separated from that body by adding excess of ammonia to the alcoholic solution of both alkaloids; the morphine is precipitated, the other remains in solution. Pseudomorphine is tasteless, insoluble in water, alcohol, ether, chloroform, carbonic bisulphide, and dilute sulphuric acid, easily soluble in potash, soda, or lime solutions, and in alcoholic solution of ammonia, sparingly so in aqueous solution of ammonia; it does not neutralise the acid reaction of even the smallest quantity of chlorhydric acid; it dissolves in concentrated sulphuric acid with an olive green, in concentrated nitric acid with an intense orange red, in ferric chloride with a blue colour. At 120° it loses 2 eq. water of crystallisation; at higher temperatures it turns yellow and decomposes without melting. Its formula is $C_{34}H_{19}NO_8$, containing therefore O_2 more than morphine, but it does not result from an oxidation undergone by morphine in its preparation; it may, however, be identical with Schützenberger's oxymorphine obtained by acting on morphine with potassic nitrite. Platino- and auro-pseudomorphinic chlorides are amorphous; the sulphate is very like calcic sulphate. The oxalate, tartrate, nitrate, chromate, chloride, and iodide are described: they are sparingly soluble; the crystalline precipitate with mercuric chloride is very little soluble in chlorhydric acid.—(*Ann. Chem. Pharm.* cxli. 87.)

Nitrogen and Carbon in Iron and Steel.—L. Rinman. To determine nitrogen the sample is dissolved in chlorhydric acid (sp. gr. 1·12), air being excluded; the ammonia formed is expelled by lime and titrated. Numbers so obtained did not reveal any connexion between the quality of the steel and its percentage of nitrogen. The iodine method for determining the total carbon is sufficiently accurate. Tempered steel dissolves in hot or cold chlorhydric or sulphuric acids without carbonaceous residue; untempered steel dissolves in hot acid without, in cold acid with, carbonaceous residue. Iron dissolved in acid sets free carbon in three states: as graphite in pig iron, as ferrocarbon in untempered steel, as hydrocarbon in tempered steel. Numbers obtained from different samples of iron are given.—(*Oefvers. af Akad. Förh.* xx. 443.)

MISCELLANEOUS.

The Royal Society.—The candidates for the title F.R.S. this year are more numerous than we have ever before known them to be. They are sixty-one in number, and comprise several gentlemen whose names are well known to the readers of the Chemical News. Amongst them we notice B. F. Duppa, Esq., author of numerous chemical researches, published in the *Philosophical Transactions*, conjointly with Dr. Frankland; P. Le Neve Foster, Esq., Secretary of the Society of Arts; Daniel Hanbury, Esq., Pharmaceutical Chemist; A. G. Vernon Harcourt, Esq., Secretary of the Chemical Society; Jabez Hogg, Esq., the well-known microscopist; E. J. Lowe, Esq., the meteorologist; Nevil Storey Maskelyne, Esq., Keeper of the Mineral Department, British Museum; George Matthey, Esq., the eminent metallurgic chemist; B. W. Richardson, M.D., of local anæsthesia celebrity; Charles Tomlinson, Esq., natural philosopher; Cromwell Varley, Esq., the electrician; J. A. Wanklyn, Esq., Professor of Chemistry at the London Institution; H. Wilde, Esq., whose electro-magnetic machine has attracted so much attention lately; and James Young, Esq., the discoverer of the process for making paraffin and paraffin oils in large quantities from coal. It will be noticed that among this list there are no less than five well-known chemists. It is very improbable that all these will be chosen, as the rule of late years has been to elect not more than two, and occasionally three, chemists.

Gun-cotton.—An important communication was made to the Royal Society on the 4th instant by Professor Abel, F.R.S. The subject was a continuation of the researches which this chemist has been carrying on for some years past, and treated principally of the causes which interfere with the keeping properties of gun-cotton. Gun-cotton prepared in the most careful manner has had the reputation of being somewhat uncertain in its keeping properties, and the object of these researches has been to ascertain the special conditions which would determine or prevent this decomposition. Several important points were mentioned in this paper. Thus, exposure to light was found to be a powerful cause of decomposition, and this was especially the case when the gun-cotton was very dry; moisture prevented this, and when the gun-cotton was palpably damp it could be preserved unchanged for a very long time. The speaker said that he had kept it in this manner for three years without the slightest deterioration being perceptible; he had no reason to suppose that it would not keep in this state for any length of time. Acids likewise exerted a very prejudicial influence on the stability of gun-cotton; alkalies, on the contrary, preserved it. This was stated to be the probable explanation of the superior keeping qualities of Baron von Lenk's gun-cotton, which received a final soaking in an alkaline silicate, the slight alkalinity thus conferred upon it having a very beneficial effect. Soaking in dilute solution of carbonate of soda was stated to exert an equally good action. Gun-cotton might be preserved in any quantity with absolute safety if it were kept damp. As an illustration of this fact, Professor Abel took a large ball of damp gun-cotton in his hand, and deliberately plunged a red-hot poker into the middle of it. Steam and smoke were evolved in abundance, but no further decomposition was effected beyond that produced by the actual contact with the hot iron. The lecture was very long, and contained many other interesting facts. We shall probably lay an abstract of it before our readers in an early number.

Whilst speaking of gun-cotton, many of our readers will feel interested in knowing that Messrs. Prentice and Co. are now manufacturing compressed gun-cotton, according to Professor Abel's process, for mining and quarrying purposes. The principle thus introduced secures the utmost safety and stability, whilst it increases its explosive force for equal bulks to six times that of gunpowder. If the blast is effected with no more gun-cotton than is really necessary, the air is left comparatively free from deleterious gases. The great advantage which gun-cotton possesses over gunpowder in this respect is of the highest importance when the health of the miner is considered. Dr. Angus Smith, F.R.S., in his report to Parliament upon the "Sanitary Effects of Gun-cotton," says:—"If gun-cotton could be used of a kind which gives out none of the oxides of nitrogen, an advantage of the most pleasing kind would be gained. The solid matter, the crystals and carbon, would cease to trouble the miner, as well as the sulphur compounds that follow every explosion. In every trial in which the effect on the senses or the breathing, and as far as we can judge on health, was considered, gun-cotton has come off with the highest character. I feel much confidence in speaking thus highly in its favour."

Chemical Toys.—Dr. Divers, Lecturer on Natural Philosophy at Charing-cross Hospital, corroborates, in the following letter to the *Times*, what we have so often insisted on in these pages. He says:—"Is it not time the public were cautioned against the dangers of 'chemical toys?' more especially as the printed assertions often sold with them, making them out to be harmless, are not to be relied upon. Within the last two years or so a great number of these toys have been brought out, most of them either highly poisonous or dangerously combustible. Thus, 'Pharaoh's Serpents,' composed of sulphocyanide of mercury, are highly poisonous, and during combustion evolve most noxious vapours. 'Larmes du Diable,' formed of metallic sodium, burn with great violence if they are either heated or moistened with water—in this respect exceeding phosphorus in danger—and scatter caustic alkali about the place when they are used as directed. 'Sunshine in Winter Evenings' and 'Fiery Swords,' formed of magnesium, are apt in the hands of children to cause nasty burns, through the rapidity of their combustion and the molten and white-hot particles they cast off. 'Sensation Cigarettes,' charged with guncotton, project, when fired, very noxious vapours into the mouth; 'Will o' the Wisp Paper,' 'Parlour Lightning,' 'Fireflies,' 'Aërial Glow-worms,' &c., all formed of pyroxylin, or paper rendered explosive by the action of concentrated nitric and sulphuric acids, are highly inflammable and dangerous—the latest proof of which is the terrible accident last week at Mr. Laidlaw's workshop. I have myself known bad injuries caused by experimenting with sodium and water, and also with flowers of sulphur and chlorate of potassium, the rubbing together of which in small quantities is so often recommended in books on 'Parlour Magic,' &c., as an amusing experiment, quite free from danger. The use of chemical toys in educating children in the science of natural phenomena must be exceedingly slight, and quite incommensurate with their danger."

London Water.—After a lapse of some months we return to this subject—one of vital importance—treated then, as our readers will remember, in full detail. We can now report the progress that has been made since that time, and Professor Frankland, by his high authority, enables us to show how fully our conclusions have been justified. From the very first we showed the great importance of a separate estimate of the nitrogen of the organic matter; this we pointed out in December, 1866, and, with less fulness, even before that. The *Lancet* and other medical journals quoted this suggestion as being promising, and we therefore feel the greater satisfaction in Dr. Frankland's demonstration of that fact. The future returns of the Registrar-General will, we expect, contain the total amount of nitrogen in the water, the nitrogen of the ammonia, of the nitrates and nitrites respectively, and lastly the deduced nitrogen of the organic matter in water. Dr. Frankland shows, also, clearly that the total nitrogen of the water has a kind of geological value, being the skeleton, as he fitly terms it, of the pre-existing nitro-

genised organic matter from sewage pollution. Thus, in future reports the nitrogen will hold a place of honour, in giving unmistakable evidence, both as regards past and present pollution, during every month of the year. This tabulation of results separately has been made by Dr. Frankland as yet only for one month—March, 1867—but it teaches the important fact that there was not a trace of organic nitrogen in any metropolitan water during the month. We may conclude, therefore, as Dr. Letheby has often remarked in his returns for the City of London, that London water is now harmless as far as the organic matter is concerned, and that it is to all intents and purposes a good potable, if not a very soft, water. Mention was also made by Dr. Frankland of the ill-effects resulting from the Old Ford reservoir water—effects so accurately traced by him; and this also bears out our opinion, that engineering defects, local or general, have, in almost every recent case, accounted for outbreaks of epidemic disease, whether local or general. The most important want at present also requires a remedy at the hands of the engineer, and that is a constant pressure supply. Without this there cannot fail to be occasional repetitions of the tale of the Old Ford reservoir. Dr. Frankland here again spoke of this as a matter of the highest importance. After all, then, the chemical bearings of the water question are not so momentous as others as far as the spread of disease is concerned; but as regards the utilisation of sources of supply given by nature close at hand, they yield to no others. We think, as we thought before, that the political considerations connected with a source of supply 200 or 300 miles from the place of consumption, cannot be too often brought under discussion. The magnitude of the interests at stake, and a degree of settlement for some time that should also be effected, could not fail to invest the subject with the interest that it has now, but had not a short time ago, acquired. We learn, therefore, with great pleasure that the commission appointed at the beginning of the year to report upon two of the schemes before the public, will take into consideration also other proposed sources of supply.

Composition and Quality of the Metropolitan Waters in March, 1867.—The following are the Returns of the Metropolitan Association of Medical Officers of Health:—

Names of Water Companies.	Total solid matter per gallon.	Loss by ignition.*	Oxidisable organic matter.†	Hardness.	
				Before boiling.	After boiling
Thames Water Companies.	Grains.	Grns.	Grains.	Degs.	Degs.
Grand Junction	22·21	0·75	0·56	14·0	4·0
West Middlesex	21·21	1·00	0·56	13·0	4·0
Southwark & Vauxhall	20·07	1·00	0·56	13·0	4·0
Chelsea	21·76	1·05	0·44	13·0	4·0
Lambeth	22·33	0·80	0·56	13·5	4·5
Other Companies.					
Kent	25·99	0·75	0·12	15·5	7·5
New River	18·57	0·75	0·44	12·0	3·5
East London	21·84	0·85	0·60	13·0	3·0

* The loss by ignition represents a variety of volatile matters, as well as organic matter, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

† The oxidisable organic matter is determined by a standard solution of permanganate of potash, the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

Hy. Letheby, M.B.

Precautions against Cattle Plague on the Continent.—The *Moniteur Belge* states that, by order of the Custom-house authorities of the kingdom of Prussia, the importation into Prussia from Holland, Belgium, and the Grand Duchy of Luxemburg, of the following articles is rigorously prohibited, in order to guard against the chance of bringing into Prussia the cattle disease,—viz., all horned cattle, sheep, pigs, goats, dogs, cats, pigeons, or any other kind of fowls, *dead* or *alive*, tallow, suet, lard, fresh, salted, or cured meat, dry or raw or salted hides, all kinds of hair, horns, and feathers, bones, animal offal, old clothes, rags, all forage or fodder for cattle, hay, straw, raw wool, dung material, except Peruvian guano which is certified to have come by sea; it is further strictly forbidden to import into Prussia any materials (earthenware, glass, &c.) packed in hay or straw. To convey to our readers some idea of the severity of this measure, it must be understood that it affects an unbroken line of land frontier of no less an extent than a length from north to south stretching over 364 English miles, reaching from the northern corner of the province of Groningen to the place where the Grand Duchy of Luxemburg meets French territory southward. To the westward of this line lives and thrives an aggregate population numbering fully ten millions of people.

ANSWERS TO CORRESPONDENTS.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. 0d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

Articles by Dr. Odling, Professor J. Stas, Mr. Crookes, M. Stahlschmidt, J. Wallace Young, C. A. Seely, and R. C. C. L. are in type, but are unavoidably postponed through press of matter.

M. M. Y.—Plumbago is a very good lubricator. A better one may be made by mixing it with tallow and wax.

J. Simpkin.—The book can be sent from our office by remitting its price in stamps to the publisher.

H. N. Draper is thanked for his communication. The information shall be forwarded.

J. Thomas.—Received, with thanks.

Graphitoidal Boron.—The information referred to is contained in an original article communicated by Professor Wöhler to the Chemical News more than a month ago.

A. B. is informed that, at several places in this country and elsewhere, illuminating gas (or vapour) is successfully produced, on a considerable scale, by conducting a current of air through the generators and volatile hydrocarbons of the Photogenic Gas Company, Stratford, Essex, to which Company he can apply for any further desired information on the subject.

A Constant Subscriber.—It is beyond our province to answer such questions as you put. The information sought is more engineering than chemical, and can only be obtained by applying where the processes are in full work. Dilute sulphuric acid will certainly injure cast-iron boilers; the vessels for this purpose should be of lead or Yorkshire flags.

Constant Reader.—The statements will certainly not pass muster amongst scientific chemists; but as it cannot be imagined that the author was ignorant on this point, it must be supposed that he preferred the simpler explanation as being within the capacity of a non-scientific audience.

Retention of Nitric Oxide.—H. B. Gibbins writes:—"An iron pipe at one time used for conveying sulphurous acid fumes into a chamber had been out of use for certainly eight years, and was choked up. On its being broken up for old iron, the solid mass contained in it gave off red fumes of nitric peroxide; so I conclude that either that or nitric oxide must have been imprisoned in a solid form all these years whilst the pipe had been disconnected from the chamber."

W. H. Harrison.—1. We know nothing better than good copal varnish for coating photographic transparencies on opal glass. Probably some compound of silica, such as its aqueous solution, one of its ethers, or an alkaline salt, might be made to answer, but experiments on this subject are wanting. 2. In experiments with the spectrum camera, the writer found that no alteration in the alkaline and metallic bases united with the chlorine, bromine, or iodine in the collodions used had the slightest influence on the length of the spectrum photographed. 3. The spectrum camera described by the writer in vol. ii., page 292, of the *Journal* of the Photographic Society, gave a spectrum about three inches long. In order to increase the length of the spectrum without altering the size of the apparatus, the lens which projects the image of the spectrum on to the screen (which was twelve inches focal length) must be shortened in focus or placed nearer the slit. 4. The nomenclature complained of is being generally adopted in chemical literature. It has many advantages over that formerly in use.

Received.—B. W. Gibsone, M.A., &c.; C. H. (a subscriber).

Books Received.—"Proceedings of the American Pharmaceutical Association at the Fourteenth Annual Meeting held in Detroit, Mich., August, 1866."

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Correct Adjustment of Chemical Weights, by William Crookes, *F.R.S.*

A set of grain or gramme weights, as ordinarily supplied by even the best instrument-maker, is never absolutely exact. However carefully they may be adjusted, the pieces of metal which respectively represent 1000 grains, 100 grains, 10 grains, &c., are only more or less approximations to the true weights. It is impossible for any one to adjust them with absolute accuracy. Indeed, the best makers readily acknowledge this, and are careful not to guarantee the correctness of their weights beyond certain limits.

In most chemical analyses the error arising from inaccuracies in the weights used is so small in comparison to errors of manipulation, or to imperfections inherent in the chemical processes adopted, that it may generally be disregarded; but when the chemist has for his object the determination of an atomic weight, or is engaged in other researches demanding the highest refinement of accuracy which chemistry and physics can supply, then he is bound to neglect no correction which will increase the precision of the results.

That chemists, whose well-trained reasoning powers allow them to take for granted nothing which is capable of experimental verification, and who insist upon the utmost attainable precision in their balances, should, as a rule, entirely neglect the probable errors which the inaccuracies of their weights may introduce, is somewhat surprising.

For the four last years I have been engaged in an investigation, the results of which will shortly appear in this journal. In carrying out this investigation, it has been my endeavour to avail myself of every possible refinement to insure accuracy. In order to eliminate the errors introduced by varying atmospheric pressure, the weighings, and many of the chemical reactions have been performed in a vacuum. It is not my intention in the present paper to discuss the subject of weighing *in vacuo*; but as many friends from time to time, whilst witnessing my methods of weighing, have expressed a wish to have placed on record, for future reference, the plan adopted for adjusting weights, and as, moreover, I am not cognisant of the existence of any published directions, except those cited below, I am induced to place a short notice of my method of procedure before the readers of the Chemical News. Let me commence by disclaiming any originality in the process. Professor W. H. Miller, of Cambridge, in his classical researches on the determination of the standard pound (*Philosophical Transactions* for 1856, pp. 811, 827, 937), has given full directions for attaining a similar object. These, however, will not exactly apply to the systems of weights used by chemists; for of the three cases described by him, the former two concern a peculiar system of weights, and in the third, two sets of weights, one for the Exchequer, the other for the Royal Mint, were compared at the same time. To this paper, as well as to the learned author himself, I am indebted for an immense store of valuable information on the subject of weights and weighings.

It may make this description clearer if I give exactly as they were performed the details of the adjustment of a set of brass grain-weights, with which some of my earlier researches were carried out. These weights, new, and made by one of the best English firms, Messrs. Ladd and Oertling, may, therefore, be considered as accurate a set as any in ordinary use.

For nearly every process in which weights are used in chemistry, the object is not to ascertain the *absolute* weight of a substance in terms of a grain or gramme, but to determine its *relative* weight, in comparison with that which it possessed at some other time before it was submitted to certain analytical or synthetical operations. If the weighings are performed with the same weights, it does not at all matter whether the weights are absolutely of the value which they profess to be, but it is very important that they should bear a known proportion to each other. The highest weight (1000 grains) in the set should be taken as the standard. It is immaterial whether or not this is accurately 1000 standard grains,* but, *calling it* 1000 grains, the value of the other weights should be known in terms of this weight with the greatest attainable accuracy.

The first operation consists in taking the specific gravities of each brass weight. The density of the larger weights must be ascertained at least to the second place of decimals, and that of the smaller ones to the first place. The specific gravity of each weight should be separately determined; for brass weights, even of the same set, differ greatly in density among themselves. A variation of not more than 0·5 in the specific gravity of the 1000 grain weight, will cause a difference in the amount of air it displaces of about 0·001 grain.

The balance being brought into equilibrium, the 1000 grain weight is placed in the left pan, and in the right are placed the 600, the 300, and the 100 grain weights. It is now found that, to bring the balance back to equilibrium, a slight additional weight has to be placed on the right side, to supplement the three weights already in that pan. This is noted. The weights are then removed to the opposite pans, the 1000 grains being on the right, and the three smaller weights on the left. It is now found that a small weight has to be subtracted from the side carrying the three weights, in order to produce equilibrium. The weights are removed and interchanged in this manner ten times, so as to eliminate, as far as possible, the errors arising from observation, or the unequal expansion by heat of the arms of the balance; and by applying the method of least squares to the results obtained, we at last arrive at the equation

$(1000)\dagger = (600) + (300) + (100) + 0{\cdot}00106$ grains . . . *a*

In a similar manner the values of the (600), the (300), and the (100) weights are ascertained in terms of the other weights, thus—

$(600) = (300) + (200) + (100) - 0{\cdot}00485$ grains . . . *b*

$(300) = (200) + (100) - 0{\cdot}00574$ grains . . . . *c*

$(200) = (100) + (60) + (30) + (10) + 0{\cdot}00057$ grains . *d*

$(100) = (60) + (30) + (10) + 0{\cdot}00105$ grains. . . . *e*

We now have data for ascertaining the absolute values of the larger weights in terms of the (1000) weight, taken as standard. Adding *a* and *b* together gives—

$(1000) = 2(300) + (200) + 2(100) + 0{\cdot}00591$ grains . . *f*

Multiplying *c* by 2 gives—

$2(300) = 2(200) + 2(100) - 0{\cdot}01148$ grains . . . *g*

Subtracting *e* from *d* gives—

$(200) = 2(100) - 0{\cdot}00048$ grains . . . . . *h*

* This must be understood as referring only to ordinary chemical research in synthesis or analysis. In many physical investigations it is of great importance that the 1000 grain weight should really represent 1000 normal grains, or that its deviation from that value should be accurately determined. But I confess I do not know where a standard weight suitable for such a comparison is to be me with.

† For distinctness, when speaking of the pieces of brass which are stamped 1000, 600, 100 grains, &c., I represent them by their nominal value enclosed within brackets.

Now, by adding f, g, and three times h, we get—

$$(1000) = 10(100) - 0{\cdot}00701$$

$$\therefore \frac{(1000)}{10} = (100) - 0{\cdot}000701.$$

and

$$\therefore (100) = 100{\cdot}000701 \text{ grains.}$$

Substituting this value for the (100) weight, we get from equation e—

100·000701 grains = (60) + (30) + (10) + 0·00105 grains,

or

(60) + (30) + (10) = 99·999651 grains.

From equation d we get—

(200) = 100·000701 + 99·999651 + 0·00057 grains.

or

(200) = 200·000922 grains.

From equation c we get—

(300) = 200·000922 + 100·000701 − 0·00574 grains,

or

(300) = 299·995882 grains.

From equation b we get—

(600) = 299·995882 + 200·000922 + 100·000701 + + 0·00485 grains,

or

(600) = 600·002355 grains.

The next step is to ascertain the value of the smaller weights. It is now necessary to obtain a second 10 grain weight. This I will call (x); and I will assume that—

$$(60) + (30) + (10) = 100 \text{ grains} \pm i.$$

(In this case, from equation e, the value of i is seen to be − 0·00035 grain.)

By an exactly similar mode of intercomparison, the following equations are now obtained:—

$(60) = (30) + (20) + (10) + 0{\cdot}00270$ . . . . . k

$(30) = (20) + (10) - 0{\cdot}00037$ l

$(20) = (10) + (x) - 0{\cdot}00103$ . . . . . m

$(10) = (x) \pm 0{\cdot}00000$ . . . . . n

Then, by repeating the above process of adding, multiplying, or subtracting, we finally get the true values of these smaller weights. The same process is then to be extended to the whole of the other weights.

The value of the weights thus given is, however, their weight in *air* of the ordinary pressure. It therefore becomes necessary to reduce them to what they would be worth in a vacuum. All bodies displace a bulk of air equal to their own volume, and the weight of this air is therefore greater as their specific gravity diminishes. In delicate investigations this loss of weight in air is important; for 7000 grains of brass displace, roughly, one grain of air.

By proceeding according to known rules, the value of the weights *in vacuo* is finally ascertained, and the results are embodied in the following table.‡ It is assumed that the (1000) weight really weighs 1000 grains in air:

Names of the weights.	Value in air in terms of the (1000) grain weight.	Value *in vacuo* in terms of the (1000) grain weight.	Weight of air displaced by each.	Volume of weights in grs. of water of maximum density.
	grains.	grains.	grains.	
(1000) .	1000·0000	1000·1462	0·1462	119·193
(600) .	600·0023	600·0904	0·0881	71·812
(300) .	299·9959	300·0401	0·0442	36·035
(200) .	200·0009	200·0303	0·0294	23·930
(100) .	100·0007	100·0153	0·0146	11·868
(60) .	60·0007	60·0091	0·0084	7·140
(30) .	29·9988	30·0040	0·0052	3·538
(20) .	19·9991	20·0030	0·0039	2·358
(10) .	10·0001	10·0015	0·0014	1·166

these corrections are individually small, it

‡ ...uding the table to unnecessary limits, I omit the ...ains.

is not right to assume that they may be neglected. The weights submitted to the above adjustment were exceptionally good, and must not be considered as fair representatives of those usually employed in analysis. I have met with weights in which the deviations from their true values were one hundred times as great as in the foregoing instance; and as no one can be certain that some of his weights are not faulty, it is best to ascertain their relative values once for all; for as the deviations are sometimes in excess and sometimes in defect, they are liable to accumulate in one or the other direction, and thus produce errors in weighing of considerable magnitude.

Having ascertained their true value, the weights ought to be carefully preserved. No attempt should be made to get them more accurately adjusted by adding to or removing portions of the metal, and they should not be picked up with metal forceps, as they suffer thus by wear and become lighter.

When possible the chemist should always use platinum weights. After adjusting the weights in question, I found that, owing to the accumulation of tarnish on their surface, there was danger of their becoming faulty. I accordingly procured from Messrs. Johnson and Matthey another set, the separate weights of which were turned out of bars of well-fused platinum. After having bestowed several months' labour upon them, I have now the satisfaction of knowing that they are as near perfection as could reasonably be expected. They have been in use for nearly three years, both in air of the ordinary pressure and *in vacuo*, and comparisons made a few days ago show that their values remain absolutely unaltered.

On Natroborocalcite, its Formula and Associations, by Professor How, *D.C.L., Windsor, Nova Scotia.**

In this journal, February 22, 1867, Dr. G. Lunge proposes a new formula for boronatrocalcite, which interesting mineral, he says, has been examined by many chemists with varying results, some declaring it to be a borate of calcium containing sodium salts as impurities, while more judicious inquirers have found it to be a double borate of calcium and sodium. He quotes Dr. Kraut as proving from former analyses and his own that, by duly allowing for never-failing admixtures, the composition of the mineral is represented by an expression which he calls Kraut's formula. Now, since no date is given for Dr. Kraut's investigation, and, from the references in Dr. Lunge's paper, it appears to be quite recent, I beg to point out that about ten years ago (*Edin. New Phil. Journal*, July, 1857, and *Silliman's Journal*, September, 1857) I proposed the formula attributed to Dr. Kraut as correctly representing the composition of natroborocalcite, found here in an altogether new geological position — namely, in gypsum after it had been carefully washed with cold water till free of sulphuric acid, of which the unwashed mineral contained a little over 1 per cent. with a trace of chlorine. All the soda remaining would of course be as borate, and I found percentages agreeing very closely with those required by the formula I gave—viz.:

	Found.	Calculated.
Soda . . .	7·21	7·82
Lime . . .	14·20	14·12
Boracic acid .	44·10	44·02
Water. . .	34·49	34·04
	100·00	100·00

* Communicated by the author.

from which it is obvious that I had very good grounds for the expression referred to—

$$NaO,2BO_3+2CaO,3BO_3+15HO,$$

which Dr. Lunge calls Kraut's formula, and rejects from finding in his own analysis more water and less soda and lime.

With regard to natroborocalcite having been considered to be a borate of calcium, I may state that I subsequently (*Silliman's Journal* and *Edin. New Phil. Journal*, 1861) collated nine analyses, which were all I could then find as having been made of the mineral, and, as two of them showed no soda, pointed out the probability of there being two species confounded under the same appellations. This has been accepted as the real state of the case (Tenth Supplement to Dana's Mineralogy, *Silliman's Journal*, September, 1862, p. 206), and, indeed, is proved by the analyses giving no soda, which Dr. Lunge rightly rejects as having nothing to do with natroborocalcite—such being, in fact, analyses of the mineral species now distinguished as hayesine, and represented by the formula $CaO,2BO_3+6HO$.

I may mention, also, that in my paper of 1861 I proved the existence of a second hydrated borate of soda and lime, differing most distinctly in crystalline form and composition from natroborocalcite, very near the locality of which it was found associated with and sometimes characteristically imbedded in Glauber salt, which I called cryptomorphite. This mineral contains 59 per cent. of boracic acid, and does not seem to have been found with the other borates at Iquique and elsewhere, as the amount of boracic acid obtained on analysis is not sufficiently high to be accounted for by its unsuspected presence. On looking back to my notes of the first finding of natroborocalcite here, dated March 18, 1857, I find reason to believe that cryptomorphite was observed at the same time, but left unexamined. The facts noted are really very curious, as pointing to the possible existence of a mineral which is sometimes the parent of both the hydrated borates mentioned. What I find in my notebook is substantially the following :—

"I think it possible that the mineral (natroborocalcite) as it occurs in the silky needles is really a product of alteration by efflorescence of another. Dr. Harding showed me, among specimens like my own (rounded masses such as are found at Iquique), some groups of transparent crystals, perhaps rhombic, aggregated into mammiliated masses of about half an inch in diameter; he gave me a few, and in a day or two they had effloresced, and their surfaces being broken they seemed to have the silky lustre, while of the part remaining transparent a portion was found not to dissolve in water, but to separate into distinct, small, transparent (rhombic ?) [*sic*] crystals which speedily went up in hydrochloric acid. In other cases the efflorescence seems now going on, and on breaking crystals which originally were transparent in appearance, the silky needles are found in the interior. The finest specimen, which two days ago I saw altogether or almost entirely transparent, is now covered with opaque efflorescence, and I think the silky needles are quite obvious in the interior. Analysis showed the portions remaining transparent to be chiefly Glauber salt."

I conclude now from this note that the silky needles were natroborocalcite, and that the rhombic crystals, soluble not in water but in hydrochloric acid, were cryptomorphite, and that both minerals either were underlying Glauber salt, which alone effloresced, or were formed from a mineral of which this last was a large constituent. The natroborocalcite itself is, as above mentioned, also found here in rounded masses, exactly such as occur at Iquique; these are imbedded directly in gypsum, so as to leave no cavity whatever, and show an origin other than that possibly indicated in the note transcribed.

While on this subject I may as well correct a statement made by my friend Professor O. C. Marsh, of Yale College, which, if left unaltered now that the minerals in question are better understood, can only mislead. I refer to his giving ("Catalogue of Mineral Localities in Nova Scotia, &c.," *Silliman's Journal*, January, 1863) hayesine as one of the minerals found in the gypsum of Windsor; this species has never been met with here; the only borates found are natroborocalcite and cryptomorphite.

Analysis of a Fossiliferous Limestone containing a Magnesian Silicate, by J. WALLACE YOUNG.*

As the study of the metamorphism of rocks is daily gaining in importance, it may not be uninteresting at the present time to direct attention to an altered coralline limestone of carboniferous age, which was obtained from a quarry near Kircaldy, Fifeshire. The specimen was given me for examination by a geological friend, as he thought it contained something uncommon from the peculiar soapy feel which it possessed.

The limestone, if I may still so call it, is of a greyish colour, the imbedded corals—which are the *Lithodendron junceum* of Fleming—being a little lighter than the surrounding matrix. The corals were more distinctly observed when a few fragments were placed in dilute hydrochloric acid, to remove the carbonate of lime as much as possible; the structure, however, is hardly so well preserved as in the unaltered portions of the same limestone. As the powdered mineral was found to be only partially decomposed by HCl, even after prolonged contact, it was fused with alkaline carbonate, and the analysis carried out in the usual way for insoluble silicates. The water was estimated by direct weighing. The composition is as follows :—

Specific gravity at 15·5° C. 2·670.

	1.	2.
Silicic acid	39·91	60·59
Magnesia	22·05	33·47
Alumina and oxide of iron	2·42	3·67
Water	1·49	2 26
Carbonate of lime	34·08	
	99·95	

No. 1 is the mineral as a whole. No. 2 is the centesimal composition after deducting the carbonate of lime; it will be observed that this approaches closely to the composition of ordinary steatite. Dilute acetic acid removed carbonate of lime only; the residue did not effervesce with concentrated HCl, and contained no lime: the magnesia, therefore, existed entirely as silicate, and the lime as carbonate. The metamorphism which this limestone has undergone must of course have taken place in the wet way. The magnesian silicate which has thus displaced the carbonate of lime, may, perhaps, have been derived from the decomposition of some of the greenstone rocks, which are, I understand, found in this locality; but I throw this out only as a conjecture.

Being favoured with some small specimens of the limestone from other parts of the same quarry, I

* Communicated by the author.

examined them for magnesia, but only found very small quantities. Some pieces were crystalline, and dark in colour from the presence of organic matter, the corals being almost quite white. On subjecting fragments to the action of dilute HCl, small portions of the corals were left undissolved, as delicate white tubes, which were found to consist principally of silicic acid and lime, with a little magnesia and alumina.

Other portions of the limestone similarly treated with acid left 2 or 3 per cent. of an insoluble residue, consisting of silicic acid and alumina, with small quantities of lime and magnesia. These pieces differed entirely, therefore, from that first analysed.

Glasgow.

On the Preparation of Pure Chloride of Ammonium, by Professor J. Stas.

I. Chloride of Ammonium from the Ammonia extracted from Sal Ammoniac, purified by Aqua Regia.—Ten litres of a boiling saturated solution of sal ammoniac were added to a litre of nitric acid of specific gravity of 1·4. The liquid was kept boiling as long as it gave off chlorine. The sal ammoniac which separated from the liquid on cooling was dissolved in pure boiling water, and the solution was boiled with a twentieth of its volume of nitric acid as long as chlorine was produced. The liquid, diluted with pure water until it no longer deposited chloride on cooling, was poured upon hydrate of calcium contained in a large retort to set free the ammonia. The latter, first washed in water, was then placed into pure water. The ammoniacal solution produced was in its turn nearly saturated by a current of pure hydrochloric acid.

The chloride of ammonium, which was deposited by the liquid after its concentration and cooling, was dried at 100° by passing continuously a current of ammoniacal gas into the long-necked globe in which it was being dried. This being done, I sublimed the sal ammoniac with the least possible elevation of temperature, keeping the neck of the globe as far as possible full of dry ammoniacal gas.

The chloride volatilised without leaving the least trace of carbon—a proof that the sal ammoniac contained no compound ammonia. However, it was easy to perceive that the bottom of the globe, which was of ordinary glass, was very slightly attacked. On breaking it to detach the sublimed chloride, I found, in fact, that traces of chlorides of sodium and calcium were formed at the expense of the substance of the glass, and that some silica was set free. By means of spectrum analysis I found that the sublimed sal ammoniac, which was quite colourless and remarkably transparent, contained traces of sodium, but it was absolutely free from calcium.

In order to eliminate the traces of sodic chloride, which were carried over with the vapour of the sal ammoniac, I sublimed it two more times in an atmosphere of ammonia, at the lowest possible temperature, devoting to this operation some *hard glass* vessels that I had had made expressly for the transformation of the alkaline chlorides into nitrates of these metals. At the temperature at which the chloride of ammonium was sublimed these vessels resisted its vapour perfectly. In the notice "*On the Transformation of the Chlorides into Nitrates*," I give the composition of the glass of these vessels.

The chloride of ammonium, before being employed in this determination, was heated, in the same vessel in which it was weighed, up to the point of giving off vapour, so as to drive off the condensed ammonia.

II. Chloride of Ammonium produced by means of Ammonia prepared from the Commercial Sulphate.—To prepare chloride of ammonium by means of ammonia, from commercial sulphate, I first treated the latter compound as follows:—Two kilogrammes of sulphate were heated with a kilogramme and a half of concentrated sulphuric acid up to the temperature at which the sulphate begins to decompose with effervescence. I then introduced nitric acid by degrees into the mixture until the liquid, which was of a tolerably strong blackish-brown colour, had become quite colourless. The compound ammonias and organic matters contained in the sulphate are thus completely destroyed, with liberation of carbonic anhydride.

The acid sulphate, suitably cooled, was poured into about ten times its volume of cold water, and the excess of acid nearly saturated by lime water. When the sulphate of calcium was deposited, the supernatant liquid was mixed with a sufficient excess of slaked lime contained in a very large globe, and was heated in a bath of a saturated solution of common salt, so as to drive off the ammonia it contained. The latter, after washing in water, was put into pure water.

The ammonia, when dissolved, was saturated by a current of pure hydrochloric acid. The solution of sal ammoniac produced was evaporated to dryness in a globe of *hard glass*, and the residue was sublimed in an atmosphere of ammonia obtained from part of the same chloride.

The sal ammoniac volatilised without leaving a trace of a residue. The sublimed product was absolutely colourless; it gave off an ammoniacal smell. Before being employed it was heated until vapour was given off, so as to drive off the condensed ammonia.

The Reducing Properties of Zinc, by M. Stahlschmidt*—*Preparation of Nitrites, by M.* Erdmann.†

M. Schönbein has shown that alkaline nitrates, in solution in water, are partially reduced to nitrites, when a zinc or cadmium wire is plunged into them. This reaction, which is naturally slow, may be accelerated until it is available as a method of preparation.

For this purpose M. Stahlschmidt uses powdered zinc, especially the residue of manufacture, used as a colour, and known as *gris de zinc*, and which should be previously treated by a little diluted sulphuric or hydrochloric acid, until a disengagement of hydrogen takes place. By this means the oxide and carbonate of zinc are eliminated, the other metals remaining intact.

The reduction of nitre is effected, especially when hot, to the point of disengaging ammonia, from which moment the production of nitrite takes place rapidly.‡ Upon this fact the author has built the following process of preparation, in which free ammonia plays a part:—

Take a solution of saltpetre saturated at 30 or 40° C., add a tenth of its volume of ammonia, and a certain quantity of powdered zinc. Shake and cool the liquid from time to time to prevent its becoming heated above 50° C., add more zinc, and continue the treatment while any saltpetre remains.§

* *Ann. Physik und Chem.* cxxviii. 467.

† *Journ. prakt. Chem.* xcvii. 388.

‡ To ascertain the presence of nitrate in the nitrite, take a little of the solution and expel the ammonia by boiling; decant, and add alcohol (about three or four times the volume). If there is much nitrate, a crystalline precipitate will be obtained; if not, only a turbidity will be produced.

§ If there be an excess of saltpetre and zinc, the reaction becomes energetic, and caustic potash and free nitrogen are formed. This resembles the action of the amalgam of sodium, which, according to M. de Wilde, produces analogous effects.

When it has nearly disappeared, cool, decant, and then boil the liquid to expel ammonia, and filter to separate the oxide of zinc. The liquid will retain small quantities of zinc; add a little carbonate of potash, then pass a current of carbonic gas, and zinc and cadmium will be precipitated. Then neutralise by weak nitric acid, after which the nitrite and nitrate of potash may be separated by crystallisation.

The process proposed by M. Erdmann is founded on an analogous reaction. It consists in keeping in melted saltpetre several times its weight of iron filings or turnings. Decant the salt when it may be supposed to be sufficiently rich in nitrite, and recharge the crucible. Then dissolve and concentrate it so as to separate by crystallisation the nitrate which has escaped reduction, and neutralise by nitrous gas prepared with starch and nitric acid.‖

Gris de zinc reduces nitric ether in the same way; it reduces iodates into iodides, turns red prussiate yellow, and decolours indigo.

It has no action on chlorates; it attacks sulphides, and in some respects behaves like oxide of copper—for instance, it rapidly converts sulphide of barium into hydrated baryta, itself turning into sulphide of zinc.

TECHNICAL CHEMISTRY.

On the Use of a Tin Bath in the Fabrication of Lighting Gas from Liquid Hydrocarbons, by M. Riaton.

The inventor states that in the manufacture of lighting-gas from liquid hydrocarbons the hydrocarbons must be at a very high temperature, but the gas must be exposed to this as little as possible.

In the ordinary process the hydrocarbon is made to fall drop by drop in a red-hot retort. It instantly forms a deposit of carbon, which intercepts the heat, and can only vaporise the drops which come after.

If a bath of melted tin be placed in the bottom of the boiler, so that each drop falls upon the red-hot metal, the gas escapes, a deposit of carbon forms and lowers the temperature of the bath. This repeated difference of temperature between the upper and lower parts of the bath causes constant movement, which, by a particular arrangement, causes the carbon to accumulate between the pipe conducting in the hydrocarbon and the sides of the retort; it is removed through a lateral orifice. The gas must be immediately drawn off by an aspirator.

PHARMACY, TOXICOLOGY, &c.

The New Pharmacopœia (1867).

[THIRD NOTICE.]

The list given in the text of the substances the names of which have been altered, calls for much commendation, but is also liable in many cases to the charge of want of consistency. Brevity is not recognised now, as hitherto, as the test of rigid accuracy. All the vegetable substances have appended to them a mention of the part of the plant officinal; thus, Rosæ caninæ fructus, Rosæ centifoliæ petala, Rosæ gallicæ petala, replace respectively Rosa canina, Rosa centifolia, Rosa gallica. This change is a sweeping one, but the expediency of it will be doubted by no one. By this general expression the part of the plant will always be borne in mind; formerly the part of the plant only was mentioned when two or more parts of the same plant were officinal—one used for one preparation, the other for another, as was the case with conium, when leaves and fruits were used.

It was recognised as a principle in the last edition that the patient should know what drug he was taking from the prescription, the diminished chances of poisoning by mistakes of the druggist being supposed to more than counterbalance the harm possibly effected by the fears of the patient at taking strong remedies. Upon this principle were framed the expressions—Hydrargyri corrosivum sublimatum, Calomelas, Pilula opii, Pulvis kino cum opio, &c.

The editors of the present edition take just the opposite view of the question, and to the foregoing substances give the following names:—Hydrargyri perchloridum, Hydrargyri subchloridum, Pilula saponis, Pulvis kino compositus, &c., each for each.

Now, this is altogether a matter of opinion, and everybody has his own views on the subject; for our part we think that the late plan was the most straightforward, and was not open to a sort of lurking suspicion of mystification about it. Why should an opium pill be called Pilula saponis, soap being only a basis, and a basis, too, of so many preparations of the kind? If adopted at all, the idea should, we think, be exhausted; for the consistency of the thing, would it not be better to call liquor strychniæ, *liquor innocuus*, and liquor arsenicalis, *aqua Toffanæ?* The fears of patients would not then be aroused by knowing that they were taking arsenic and strychnia.

The expression of the old British Pharmacopœia, Ferrocyanide of potassium, seemed to us to be beyond all criticism for preparing hydrocyanic acid; its name has, however, been altered to Potassæ prussias flava. We should have thought that prussias would have sounded dangerous to the Pharmacopœia Committee as being too suggestive of prussic acid. So now hydrocyanic acid is prepared from prussiate of potash, the latter of which, however, does not appear in prescriptions. We have noticed that an enlargement of phrase is given to some substances. Confusion results in many cases: thus, the late Ferri peroxidum hydratum is now called Ferri peroxid. humid., and in the new book Ferri peroxidum hydratum is used for the late Ferri peroxidum.

The old sulphuret is extinct now; for Antimonii sulphuretum, read Antimonium nigrum.

The names of many salts are altered, but without the slightest method traceable. (1) In some cases a scientific name replaces a pharmaceutical one; in others (2) just the opposite—

(1) Brit. Pharm., 1867.	Brit. Pharm., 1864.
Bismuthi subnitras	Bismuthum album
Plumbi oxidum	Lithargyrum
(2) Brit. Pharm., 1867.	Brit. Pharm., 1864.
Soda tartarata	Sodæ et potassæ tartras
Unguent. zinci	Ung. zinci oxidi

The substances remaining the same. Further, there may be some reasons for the following, which are not obvious:—

Brit. Pharm., 1867.	Brit. Pharm., 1864.
Ammonii chloridum	Ammoniæ hydrochloras
Potassæ prussias flava	Potassii ferrocyanidum.

The new nomenclature is not in every case consistent the influence of the bad notation is detected in it.

‖ Former observations have ascertained that this gas gives very little nitrite; however, it neutralises alkaline liquid, and that by forming nitric acid. The object would then be more rapidly obtained by neutralising with this acid, which, after all, introduces no new element into the liquid. For the application of these principles see *Annuaire de Chimie*, 1849, p. 102.

As was before said, the names of compounds are given in Latin. Pharmacy Latin is not altogether beyond criticism when applied to chemical substances with English names; for by the rule that gives Iodum and Chlorum for Iodine and Chlorine, Glycerine should be Glycerum, whereas the series of compounds before alluded to are called Glycerina. The latter term, as applied to a mixture of glycerine and water with some acid, is, to say the least, awkward-looking. Old mistakes in this department have been again overlooked, for is not the strength of spiritus *rosmarini* diminished one-fifth? Horace (an amateur physician, by the way), had he lived till now, would doubtless have seen just reason for writing to Phidylo in more modern Latin—not to Phidyle as

> "Parvos coronantem *marino*
> *Rore* Deos, fragilique myrto."

But the pharmacist must not be deprived of his Latin on any consideration.

Chemical substances appearing for the first time in a national Pharmacopœia are numerous, and very justly introduced. The first on the list is Acidum carbolicum; then there is the Sulphate of atropia, followed by Bismuthi carbonas, Bismuthi et ammoniæ citratis liquor, Cadmii iodidum, Cerii oxalas, Ammoniæ citras, Arsenici hydrochloras, Morphiæ acetas; among the liquors, effervescing liquors of Lithia, Soda, and Potash; Sulphuris iodidum is restored from the London Pharmacopœia, Acetate of iron in a tincture from the last Dublin one.

PHYSICAL SCIENCE.

Action of the Induction Spark on some Gaseous Hydrocarbons, by M. P. DE WILDE.

Acetylene.—Introduce the dry gas into a small eudiometer over mercury, and furnished with two platinum wires about 4 millimetres apart. At the passage of the spark, a light tuft of carbon is formed between the wires, and the action stops. Agitate the eudiometer, so as to cause the mercury to knock off the carbon, and the sparks which again pass will reproduce this phenomenon. The eudiometer is shaken as often as necessary for the continuation of the experiment. If operating with 10 cubic centimetres of gas, from fifteen to twenty agitations will suffice; the experiment will then proceed uninterruptedly. In ten or fifteen hours all the acetylene will be decomposed. The remaining gas submitted to eudiometric analysis is found to be hydrogen. The acetylene should give its volume of hydrogen, but there is always a diminution of about a fifth, which, may, perhaps, be attributed to the absorption of hydrogen by the deposited carbon, or, perhaps, to the formation of some trace of condensed hydrocarbons. The result of this experiment is, that acetylene decomposes into its elements under the influence of the induction spark.—*Bulletin de la Société Chimique de Paris*, vi. 267.

Uses of Sulphate of Magnesia.—A strong solution of sulphate of magnesia mixed with whitewash will produce a beautiful white for ceilings of rooms in houses. It will, if used in the same way, be found useful for rifle targets. A small quantity of this salt used along with starch adds considerably to its stiffening powers, and renders the articles to a certain degree fireproof.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, April 16, 1867.

The unexpected observation of the *Lycoperdon giganteum* has led M. Ernest Baudrimont to some very interesting conclusions. Fourteen days after its apparition at the surface of the ground it had acquired a considerable size. Plucked on September 17, 1866, when it commenced to decrease visibly, it was nearly of a regular spheroidal form, with a very short peduncle of a very beautiful white colour, dull, and slightly rosy; the skin was distended, and elastic under the pressure of the finger; its circumference measured 1 m. 4 c. on its greatest diameter, the weight being 3 kilo. 500 grammes. When detached circularly by means of a sharp instrument, a great quantity of turbid liquid was disengaged of a greenish-yellow colour. It was placed immediately in a baking-oven, where it remained twenty days. Taken out completely dried, it weighed 305 grammes, thus showing that before desiccation it contained 91·28 per cent. of water. Analysis has proved that nitrogen gas represented alone 8·96 per cent. of the weight of the dried fungus, or 0·78 per cent. of the weight of it in its normal state. If we suppose all this nitrogen to have been in the state of albumen, a substance which contains 17·70 per cent. of nitrogen and 53 per cent. of carbon, the total mass of lycoperdon (305 grammes) contains 174·063 grammes of carbon; we have even 142 grammes by adding the carbon contained in the non-nitrogenised substances, its cellulose, &c. This being ascertained, we have 142 grammes of carbon representing 520·66 grammes, or 265 litres of carbonic acid, and thence 530,000 litres of air. It is from this enormous volume of air, which is about equal to a cube of 8 metres linear edge each way, that the fungus in question must have drawn, without losing a single trace, and, if we may so term it, with mathematical precision, the 142 grammes of carbon necessary for its development of fourteen days. This is at the rate of, per day of twenty-four hours, 10·15 grammes of carbon, 18·9 litres of carbonic acid gas, and 37·800 litres of air. At 86,400 seconds per day, it is upon nearly half a litre of air that the plant must have operated per second to effect the total extraction of the carbonic acid gas which was in it. By what means can we estimate the prodigious activity that this inferior plant could develope to be able to take in fourteen days all the carbonic acid belonging to 530,000 litres of air? How astonishing, then, must be the delicacy of the absorptive organs which seize on its flight an elastic fluid—if we may so call it—intangible, disseminated in such an enormous mass, continually moving with great rapidity! But this is not all. The mean circumference of the fungus was 0·990 m.; the radius, 0·157 m.; its volume more than sixteen millions of cubic millimetres; and its mass formed of cellules 1 millimetre long at most, and the $\frac{1}{500}$th of a millimetre in thickness, between which are placed the reproductive spores. The total number of the cellules exceeds fourteen billions (14,589,140,400); and since the development lasted fourteen days, a million of cellules had to be produced every four hours—twelve thousand cellules per second! Just let one stroke of the pendulum, and then another, be heard, and conceive, if you can, that in that space of time the fungus constructed 12,000 cellules, besides (as the spores are a hundred times at least more numerous than the cellules) 1,200,000 spores, without any sensible shock or any hurried interior derangement capable of disturbing the mysterious equilibrium that reigns through all the parts of this living body. How great, then, is the prodigious energy which animates the material substance, and which can accommodate itself instantaneously to the exigencies of life!

F. Moigno.

UNIVERSAL PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Class 44. *Chemical and Pharmaceutical Products.*—We commence our description of the Exhibition with that of the department most calculated to interest the readers of the Chemical News. The industrial development of chemical products is one of the greatest importance—the more so, as it furnishes other arts with substances indispensable to their very *existence*. The production of chemical products, in France alone, represents a sum of forty-eight millions sterling. Sulphuric acid, soda, soap, india-rubber articles, and stearine candles, figure for half that sum; and, if we add the value of the dyeing materials, the reagents employed in bleaching, the manufacture of paper, painting, glass-blowing, calico printing, manures, the galvano-plastic arts, photography, gilding, the silvering of metals, &c., the 48,000,000*l.* will be easily accounted for, and perhaps exceeded. Already, in 1863, the exportation of chemical products by France amounted to 2,120,000*l.*

The chemical exhibition of 1867 is remarkably fine, and quite completed as far as regards the French section, the most advanced of all. There are no less than 358 French exhibitors; to which must be added, 44 Algerians, 40 Hollanders, 1 Luxembourgese, 85 Belgians, 125 Prussians, 17 Hessians, 7 Baden, 15 Wurtemberg, 15 Bavarians, 150 Austrians, 37 Swiss, 57 Spaniards, 16 Portuguese, 71 Russians, 2 Chinese, 1 Tunis, 30 Americans, 98 Brazilians, 2 Egyptians, 108 English, 199 Italians, 1 Pontifical, 98 Turks, 5 American Republics.

The most salient progresses accomplished since 1862 are the invention of new colouring matters obtained by toluidine and methyl-aniline, the transformation of naphthaline into benzoic acid, the industrial production of magnesium, &c.

The manufacture of stearine, originated in France, and there for the first time applied practically, can, in spite of the import duties and other taxes, compete advantageously with any other market. The good quality and the reasonable price of the candles enable the French manufacturers to maintain advantageously their ground against all competition, so that the exportation is very considerable; while the price of stearic acid of the first quality is only 1 fr. 70 c. per 100 kilos. (220 lbs.). Notwithstanding the elevated price of the original materials, the exhibition of this product holds a prominent place at the Palace in the Champ de Mars. M. de Milly, so ably assisted by his son-in-law, M. Bouis, a distinguished chemist, has made an extraordinary progress in this branch of manufacture. He suppresses the distillation of fatty matters; he treats the tallow with sulphuric acid at 55° C., and obtains a black mass, which he submits to a first pressure by hydraulic machine. The mass is by this considerably discoloured, and is of a dark yellowish-grey colour. It is then compressed a second time, by which all the oleic acid is expelled; the remaining substance is left as white as snow, and can serve at once for the manufacture of wax candles of the first quality. This result has occupied the attention of chemists and manufacturers as one of the greatest importance. M. de Milly exhibits at the same time two sorts of soap manufactured with oleic acid of the first and second pressure; they differ considerably in shade.

The glass cases of the other French exhibitors, which contain the excellent products of MM. Leroy and Durand of Gentilly, M. Venigue of Ivry, Cresenberge of Clichy, Fournier of Marseilles, Belhommet de Landernau, are admirably classified, but we do not know at present what they contain new. MM. Morani Brothers exhibit in a pavilion of the park in the French quarter, near the Pont d'Jena, all the necessary machinery for the manufacture of stearine, and set it at work every day.

One of the great novelties of 1867 is the process of the conversion of nodules of phosphate of lime into phosphate of iron, and the decomposition by the latter thus obtained of sulphates of soda and potash, to obtain tribasic phosphates of soda and potash. Discovered by M. Boblique, and applied on a large scale at the Javelle chemical works under the direction of M. Fourcade, this process has now been brought to perfection. The nodules of Ardennes contain, on an average, silica 34·50, lime 27·80, phosphoric acid 19·30, phosphorus 8·60, and other matters.

To a hundred kilos. of nodules are added sixty kilos. of iron ore, which is found nearly always at a short distance from the beds of the nodules or coprolites, and of which the composition is peroxide of iron 35·43, iron 24·80, water 6·46, siliceous or chlorite gangue 18·11. The mixture is melted in a blast furnace, and the results obtained are—1. Phosphate of lime containing on an average 20 per cent. of phosphorus. 2. Slag, containing silica 54, lime 32, alumina and magnesia 14. In order to manufacture the phosphate of soda a mixture of 100 parts of powdered phosphorus, 200 of crushed sulphate of soda, and 30 parts of fine charcoal are fused together; they are well stirred up during the fusion. Afterwards, when the reaction has taken place and the mass has become fluid, it is cast in blocks of 600 to 650 kilos. Exposed to the air for a few days it crumbles into a sort of dust, and it is afterwards submitted to a regular process of washing, by means of which are produced abundant crystals of tribasic phosphate of soda, represented by $3NaO,PO_5$. The insoluble residue is a double sulphide of iron and sodium Fe_4NaS_3, which, when roasted in a pyrites furnace, gives sulphurous acid to be transformed into sulphuric in leaden chambers; the residue is peroxide of iron mixed with sulphate of soda, which is separated by a new washing. This is evidently a complete process, in which the same sulphur and the same iron can serve indefinitely.

The phosphuret of iron and the phosphates of potash and soda resulting therefrom figure for the first time in the showcase, No. 215, of M. Fourcade, of the Quai de Javelle.

Side by side we have MM. Perret and Olivier, owners of the Saint-Bell and Chesy mines, so rich in sulphurets of iron and copper. These exhibitors have written in gilt letters on their glass case that they burn or export annually 70,000 tons of pyrites, and that the capacity of their leaden chambers amounts to no less than 40,000 cubic metres. In 1855 there was already a complaint as to the want of sulphur and its elevated price; they were one of the first to point out to the manufacturers of sulphuric acid the pyrites supply of M. Perret; they also were the first to propose the substitution of pyrites for sulphur, when, as at Newcastle, copper is extracted from the residues of the roasting.

After having mentioned these chemical items, we now turn to those of pharmacy. In the first ranks of the exhibitors of this section we must place M. Adrien, the able collaborateur of M. Jules Regnaud, Director of the Central School of Pharmacy, who has so well fulfilled the delicate mission of fabricating pure chemical products according to strictly established formulæ. His opium of Smyrna (a sort of mixture of all sorts of commercial opium), containing 10 per cent. of morphia, is much sought for, especially in the preparation of the medicines of the Codex in use in France. We may cite among some remarkable products, scammony containing 15 per cent. of pure resin.

(From another Correspondent.)

You are so accustomed in England to mercilessly criticise men in office, and your men in office are so accustomed to abuse in the public prints, that no amount of it causes any sensation. Even the persistent abuse of "Cole, C.B.," by the *Saturday Review*, has not excited attention, nor has it, that I am aware of, been neutralised by anything approaching to a fair public announcement of what we all appre-

ciate here—namely, his unceasing efforts to render the English part of the Exhibition worthy of the nation.

The chemical portion is by no means rich in new products. It is evident that the discovery of aniline colours has, in some respects, been detrimental to the progress of science. Do not misunderstand me. Of course, I am filled with admiration of the beautiful results which have rewarded the labours of so many chemists with new and gorgeous colouring matters, but it is plain that, in the pursuit of wealth, so many young and energetic chemists have devoted themselves to the study of aniline and its derivatives, that other, and perhaps as rich, fields of study have been neglected.

But if the visitor is struck by this deficiency in absolutely new substances, he is no less impressed by the magnificence and purity of the specimens exhibited. Among the novelties I observed the new blue discovered by MM. Girard and De Laire. These ingenious young chemists prepare their colouring matter by the action of sesquichloride of carbon on diphenylamine. I will give you a full account of this and other novelties in a subsequent letter.

Your readers will be sorry to hear that comments are being continually made upon the fact, that while the Germans come out in great force with dyes and colouring matters, the great English houses, whose cases at the last English Exhibition were among the most brilliant objects in the building, are wholly unrepresented. This is greatly to be regretted, as the true reasons for it will probably not be guessed at. One is continually astonished by the low prices at which the new dyes are now produced. When the complication of the processes by which they are produced is considered, it would really appear as if the profits upon their manufacture can now be little more than are obtained from the commonest chemicals. It is evident that manufacturing processes generally have been both improved and simplified, and it is to be hoped that the fall in prices is due more to those causes than to overproduction.

The natural alkaloids and the new metals are among the chemical substances which divide with colouring matters the attention of the visitors.

Most of the scientific celebrities of Europe are now in Paris, and may daily be seen studying the beauties and curiosities of the Exhibition. The jury is also in full work preparing for the awards, which we doubt not will afford the usual amount of envy, hatred, and malice.

It is unnecessary, perhaps, to tell you that the department we are considering is very unequal in interest. In a corner where it can scarcely be seen will be found a ridiculously small case containing almost priceless chemical rarities, while within a yard will be found one of six times the size devoted to the exhibition of nostrums which owe their notoriety solely to the unblushing impudence with which they are puffed.

In my next I hope to be able to give an account of some of the chemical rarities and the processes by which they are obtained.

NOTICES OF BOOKS.

A Plea for Reflectors: being a Description of the New Astronomical Telescopes with Silvered-Glass Specula, and Instructions for adjusting and using them. By John Browning, F.R.A.S., F.M.S., and F.M.S.L. London: William Francis. 1867.

The author has written this pamphlet with a view to counteract the general prejudice against the employment of reflectors in telescopes; the relative merits of refractors and reflectors are impartially described, and diagrams given of the best forms of apparatus. The whole forms a very useful work, and one which amateur astronomers would do well to consult before deciding upon what instrument to procure.

Mr. Browning begins by stating the advantages reflecting telescopes possess over refracting ones. He then describes the disadvantages that formerly led to their being almost totally discarded, and the improvements by which these defects have been remedied; and, finally, there is a description of the various forms and sizes of reflecting telescopes, and the mode of using them. The advantages of this form of instrument seem so great, and, in large sizes, the difference of price, as compared with achromatic telescopes, is so enormous, that we should think that nothing but ignorance of its merits has prevented its very general adoption by astronomers. The following, according to Mr. Browning, are the most important advantages of the best forms of reflectors:—

"They are only half the length of achromatics of the same aperture.

"Their dividing power, on many stars, is superior to that of achromatics, aperture for aperture, as they give smaller discs; and on the moon and planets their performance cannot be surpassed.

"They are quite free from the aberration of colour.

"When viewing objects in the best position for observation—that is, between the zenith and 45° above the horizon—they are much more convenient to use than refractors, because the eye-piece of the reflector remains nearly horizontal; a refractor, under the same circumstances, necessitates the observer's almost lying down on his back. Micrometric measurements may be obtained with great exactitude, from the easy position of the observer.

"The price of the specula in small sizes is only about one-fifth, and, in large sizes, only one-tenth, of that charged for good achromatic object-glasses of the same aperture.

"For instruments of equal power the new reflecting telescopes do not require an observatory half the size that would be necessary for a refractor, and a building half the size would not be one quarter the expense."

The telescopes here described are of the Newtonian form, which is thus described:—

"The Newtonian telescope consists of a tube closed at the lower end, which is occupied by a concave mirror. The cone of rays reflected from this mirror is again reflected at right angles from the surface of a small plane mirror, mounted at an angle of 45° near the open end of the tube, into the eye-piece, which is exactly opposite.

The defects which led to reflectors being so long disused were as follows:—

The alloy of which the reflectors were made was so brittle as to break sometimes by a sudden change of temperature.

Their great weight made them difficult to mount firmly.

Their surface rapidly tarnished, and could not be restored except at great expense and the risk of irretrievably injuring the mirror.

In the telescopes made by the author, and described in this pamphlet, the mirror is of glass, coated with pure silver by Liebig's process, which form has the following advantages:—

"These glass mirrors are not at all injuriously affected by change of temperature, and their lightness very considerably reduces their liability to flexure; indeed, mounted in the manner I shall presently describe, no flexure has ever been observed in them. I may, however, state that I make the discs of the specula, which Mr. With parabolises for me, out of glass nearly twice the substance of that generally used for the purpose. The coating of pure silver reflects fully one-third more light than the best speculum metal, as the alloy before mentioned is called. But the greatest superiority of silvered glass over metallic mirrors consists in the fact that should they become tarnished, their brilliancy may readily be restored by gentle friction with soft leather, and a little of the finest rouge; and even

should the silver coating become utterly spoiled, it may be easily removed without in any way impairing either the figure or polish of the glass speculum, and a fresh one deposited at a trifling cost, thus making the mirror equal to new; and this may be repeated indefinitely. Should the owner possess a little patience, he may renew the coating himself at the cost of only a few pence. The silvering process is fully described in an appendix."

The remainder of the pamphlet is devoted to a description of the various instruments supplied by Mr. Browning, and is fully illustrated. A frontispiece shows Saturn, as seen in a 13-inch metallic reflector, and Mars, as seen in an 8½-inch reflector.

CONTEMPORARY SCIENTIFIC PRESS.

Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Annales du Génie Civil. February, 1867.

De Kappelin "*On the Use of Annatto for Dyeing and Calico Printing.*"—A. Ortolan: "*Some Practical Remarks on Boiler Explosions.*"—"*Instructions for fixing Lightning Conductors to Powder Magazines, drawn up by a Commission of the French Academy of Sciences.*"—Limet "*On a Specimen of Boiler Scale.*"—Simonin "*On the Coal Formations and Metallic Veins of the Old and New World.*"—J. Roth "*On the Composition and Adulteration of the Crude Tartar of Alsace.*"—Rousseau: "*An Improvement in the Manufacture of Beetroot Sugar.*"—Junemann, Du Rieux, and Rottger, "*On the Use of Strontia in the Manufacture of Sugar.*"—Clémandot: "*A new Silica Glaze for Pottery Ware.*"—Bourne: "*A Method of Deodorising Vulcanised India-rubber.*"—Corduré: "*A Method of obtaining Silver from Argentiferous Lead.*"—Bellouhey: "*A new Process for Enamelling Iron.*"

Technologiste. February, 1867.

Wagner "*On the Manufacture of Nitric Acid.*"—C. F. Richter "*On the Preparation of Acetic Acid and Acetates from Pyroligneous Acid by means of Baryta.*"—L. Knaffl "*On the Preparation of pure Cyanide of Potassium.*"—C. Dieterich "*On the Preparation of Chrome Green.*"—J. C. Fischer: "*Historical and Practical Researches on the Nature of Purple of Cassius.*"

Annalen der Chemie und Pharmacie. February, 1867.

R. Fittig: "*Researches on Mesitylene;*" "*On Ditolyl, a new Compound Isomeric with Dibenzyl, being a Supplement to the preceding Memoir.*"—C. Bigot and R. Fittig "*On the Synthesis of some new Hydrocarbons.*"—J. Roesler "*On some Chromicyanogen Compounds.*"—S. Cannizzaro "*On Brominated Toluol.*"—L. Swiontkowski "*On the Behaviour of Solutions of Permanganate of Potash towards Peroxide of Hydrogen.*"—A. Mühlhauser "*On the Action of Cyanide of Potassium on Binitronaphthalene.*"—A. Claus "*On the Action of Iodide of Ethyl and Zinc on Sulphuric Ether.*"—A. Lieben "*On the Synthesis of Alcohols by means of Chlorinated Ether.*"—A. Ladenburg "*On the Synthesis of Anisic Acid and of one of its Homologues.*"—A. Ladenburg and A. Fitz "*On some Derivatives of Paroxybenzoic Acid.*"—A. Tenner "*On the Presence of Salt in Extract of Meat.*"—C. Huber: "*Preliminary Note on some Derivatives of Nicotine.*"—A. Baeyer "*On Mellitic Acid.*"

Archives des Sciences. January, 1867.

J. C. Marignac "*On some Fluorides of Antimony and Arsenic.*"—J. Plateau: "*Seventh Series of Experimental and Theoretical Researches on the Equilibrium Figures of a Liquid Mass without Weight.*"—"*Note on an Earthquake which occurred in Algeria at the beginning of the year 1867.*"—A. Secchi "*On the Origin of the Air Lines of the Solar Spectrum.*"—A. Mousson "*On the Ebullition of a Liquid when in Rotatory Motion.*"

Kunst und Gewerbeblatt. January, 1867.

J. Bergsmann "*On a Method of determining accurately the Melting Point of Fats.*"—"*On the Industrial Applications of and Trade in Ivory.*"—Wegler "*On the Relative Cost of Manufacturing Ice by Carré's and Siebe's Machines.*"—C. Puscher: "*A Solution for Etching Copper.*"—J. Stinde "*On Non-Explosive Glycerine.*"—G. Dachauer "*On Blue Transfer Paper.*"—"*On the Use of Oleic Acid in the Manufacture of Soap.*"—"*On the Action of Water on Lead.*"—"*On the Presence of Bisulphide of Carbon in Petroleum and Benzol.*"

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

391. Sir J. Y. Simpson, Bart., Queen-street, Edinburgh, N.B., "Improvements in the utilising of mineral and other oils for the production of heat, and for illuminating purposes."—Petition recorded February 12, 1867.

721. J. Hamilton, Glasgow, N.B., "An improved artificial material for producing gas to be used for illuminating purposes."

728. B. Platt, Liverpool, "Improvements in and apparatus for the manufacture of chloride of lime."—March 13, 1867.

737. W. G. Blagden, Hackney Wick, Middlesex, "Improvements in extracting silver from alloys of zinc with lead." A communication from F. Marquez Millan, Rue Liandier, Marseilles, France.—March 14, 1867.

744. J. R. Parkinson, Blackburn, Lancashire, "An improved varnish or composition to be applied to healds of looms for weaving, and for other similar uses."

752. G. Smith, Headingley, Leeds, Yorkshire, "Improvements in the preparation of soap adapted more especially for the scouring of wool and woollen yarns."—March 15, 1867.

766. J. Hickisson, Southgate Road, Middlesex, "An improved preparation of biscuit and other pastry and bread."—March 16, 1867.

788. A. H. Hart, Gresham Street, London, and W. Parry, Birmingham, "Improvements in treating or purifying sewage, and in apparatus to be used for that purpose."

789. C. Allhusen, Newcastle-upon-Tyne, "An improved mode of treating small pyrites, and pyrites' dust, so as to obtain sulphur therefrom."—March 19, 1867.

810. G. Bischof, jun., Poppelsdorfer Allée, Bonn, Prussia, "Improvements in coating metals, and in apparatus employed therein and for like purposes."—March 20, 1867.

814. G. E. Marchisio, M.D., Baker Street, Middlesex, "Improvements in the preparation and application of isolating compositions for the protection of metallic surfaces from oxidation, and for the preservation of wood and other materials, and in the preparation of the residue of vegetable oils to be employed for such purposes."—March 21, 1867.

Notices to Proceed.

3093. J. Mitchell, Musselburgh, Midlothian, and W. C. Laird, Leith, Midlothian, "A new or improved detergent material applicable to the cleansing of wool and other fibrous substances, and to all purposes where coarse soap is used."

3097. J. K. Leather, St. Helen's, Lancashire, "Improvements in the manufacture of salts of soda and potash."—Petitions recorded November 24, 1866.

3165. S. J. Browning, Portsmouth, "Improvements in the method of applying and arranging apparatus for distilling sea-water, and also in the mode or method of combining and using such apparatus for that and other purposes."—December 1, 1866.

CORRESPONDENCE.

Ozone.

To the Editor of the Chemical News.

Sir,—During the first three months of the present year, the more salient points in the development of ozone were as follows:—

In January there were two well-marked periods of scarcely a trace of ozone—namely, from the 1st to the 5th, culminating on the 4th, when the test was colourless, and from the 10th to the 19th, culminating on the 13th, 14th, and 18th.

Both these periods were followed by equally well-marked periods of a large development of ozone. In February no such well-marked and settled periods occurred. On some days there was but little ozone, as, for instance, on the 2nd, and the afternoons of the 21st and 28th, especially on the afternoon of the 21st; while on other days there was a good deal, as on the 16th, 18th, and 20th. But the periods of increased and decreased development were short and unsettled, often lasting not more than a few hours, and at most a day or two.

In March, there was scarcely a trace of ozone on the 1st and 2nd, and very little on the 3rd, 8th, 9th, and 16th; considerable quantities on the 13th, 25th, 27th, and 30th, especially on the 25th and 30th. Speaking generally, there was a period of scanty development of ozone till the middle of the month, and then a period of more plentiful development towards the end; but neither of these periods was well defined or settled.

There is an expression in my letter published in the Chemical News of March 1, which requires correcting. For "The period of ozone which commenced on January 20 still continues," read, "Since the period of ozone which commenced on January 20, there has been no decided period of non-ozone."

I am, &c. R. C. C. L.

Seagrove House, Bournemouth, April 9.

The Mnemonic Nomenclature.

To the Editor of the Chemical News.

Sir,—The nomenclature for which you give credit to Mr. Tillman, of New York, in the Chemical News of March 1, in fact belongs to a former generation. It had its birth in 1820-30. It was first published, fully elaborated, in Gmelin's "Handbuch," 1827. Shortly afterwards it was introduced to the English public, but modified for the sake of euphony, by John J. Griffin in his "Chemical Recreations" (first edition), pp. 67-184, and again (1834) in his little book on chemistry, pp. 245-276. It is a singular fact that Mr. Tillman appears to be the only one who lays claim to its invention. Griffin acknowledges indebtedness to Gmelin, Gmelin to Laurent, Laurent to Dumas. The precise relation of these gentlemen is as follows:—Dumas suggested that the vowels be made to indicate the number of equivalents of chlorine in compounds containing that element. Laurent suggested that such use of the vowels be extended to all the elements. Gmelin embodies these ideas in practice in a way to best accommodate itself to the German language. Griffin translates into English, and modifies the system so as more nearly to adapt it for common use. Those who are curious on the subject may consult the references above given, and Gmelin's "Handbuch" (Cavendish Society ed.), vol. vii. pp. 149-153, and Laurent's "Méthode," pp. 47-48, Paris, 1854. I am, &c.

Charles A. Seely.

New York, March 23.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Coriamyrtin (C = 12, O = 16).—J. Riban. The expressed juice of the shoots of *Coriaria myrtifolia*, the poisonous myrtle-leaved sumach, after treatment with plumbic subacetate and filtration, yields coriamyrtin to ether. 1200 kilos. of young shoots gave 87 grammes of pure substance. Coriamyrtin, $C_{29}H_{36}O_{10}$, or $C_{30}H_{36}O_{10}$, is solid, white, very poisonous, crystallising in oblique rhombic prisms, melting at 220°, slightly soluble in water, very soluble in boiling alcohol or in ether, turning the plane of polarisation to the right, neutral, not combining with acids nor with platinic chloride, containing H_2 replaceable by bromine or chlorine, $C_{30}H_{34}Br_2O_{10}$ described. Boiled with baric hydrate and water, it assimilates $5H_2O$, producing an acid. It reacts in the same way with calcic or plumbic oxide and water. The salts so formed are hygroscopic, and give up their acid if treated with sulphuric or oxalic acid. The acid when free is soluble in water, amorphous, and expels carbonic anhydride. Treated with nitric acid, coriamyrtin gives rise to small quantities of a nitro compound not analysed. With acetic anhydride it forms $C_3H_{30}(C_2H_3O)6O_{10},3H_2O$, solid, colourless, brittle, bitter, melting below 100°, insoluble in water, soluble in alcohol. A trace of coriamyrtin moistened with iodhydric acid conc., evaporated on water-bath, and taken up with alcoholic soda solution, gives an intense purple-red solution, decomposed by water.—(*Bull. Soc. Chim. Paris*, 1867, 79.)

Gaseous Volcanic Products at Santorin.—Fouqué. Observations formerly made at Vesuvius and Etna, and confirmed at Santorin, show that the quantity of hydrogen varies directly with the intensity of volcanic activity. At Santorin the proportion of hydrogen varied inversely, that of marsh-gas and carbonic anhydride varied directly, with the distance from the centre of volcanic force, or with the time elapsed from the commencement of the eruption. The quantity of sulphydric acid varies directly as the temperature. More chlorhydric acid is given off than sulphydric or sulphurous acid.—(*Comptes R.* lxiv. 189.)

Oxygen, Preparation of.—A. Mallet. An appropriate vessel containing moist cuprous chloride mixed with sand or kaolin, and traversed by a current of air, is caused to rotate; when the cuprous salt is converted into oxychloride, the temperature is raised to about 400°; rotation being continued, oxygen is then given off. The operation is continuous, and may be repeated any number of times without loss. If chlorhydric acid be employed instead of air, cupric chloride is produced from whic chlorine may be expelled.—(*Comptes R.* lxiv. 226.)

Glass.—Bontemps thinks that the easy devitrification of Pelouze's glass (Chemical News, xv. 160) is due, not to its high percentage of silica, but to the lime in it. Gaudin, indeed, has made microscope lenses of quartz fused by the oxyhydrogen blowpipe. He thinks that the yellow colour attributed by Pelouze to ferric oxide and alkaline sulphides may be due to manganese, and quotes his own experience in support; and further remarks that in his experience manganiferous soda glass turned yellow, or, if containing potash instead of soda, it turned violet.—(*Comptes R.* lxiv. 228.)

Alcohols (C = 12, O = 16).—E. Erlenmeyer. The common view of the normal alcohol series is that its members differ by increments of CH_2. Erlenmeyer finds that normal butylic alcohol is methylic alcohol in the Me of which H_1 is replaced by pseudopropyl; normal amylic alcohol is ethylic alcohol in the Me of which H_1 is replaced by pseudopropyl. Wurtz's amylenic hydrate is pseudopropylic alcohol in which Me_1 is replaced by pseudopropyl; in other words, it is ethylic alcohol in the methylene of

which H_1 is replaced by pseudopropyl. The experimental evidence will be presently brought forward.—(*Zeitschr. Chem., N. F.*, iii. 117.)

Vapour-density of Nitric Peroxide (O = 8).—H. Ste.-Claire Deville and L. Troost. Determinations at intervals of about 10° between 26·7° and 183·2° show that between 26·7° and 100° the vapour-density of this body varies between 2·65 and 1·68, between 100° and 183° it varies between 1·68 and 1·57, an amount within experimental error, and therefore negligeable: the number 1·57 corresponds closely enough to the theoretical number 1·589, NO_4, 4 volumes. If, in accordance with the views of some chemists, the formula be doubled, and written N_2O_8, then the equivalent volumes must be 8. Wurtz admits that NO_4, 2 volumes, dissociates at the moment when experiment gives 4 vapour volumes; but oxygen, meeting its equivalent quantity of nitric oxide, indicates a temperature of 98·5°, at which temperature the experimental number is 1·68, close upon the theoretical number 1·59, corresponding to 4 volumes; dissociation is, therefore, out of court. In the case of vapours condensable above 0°, what is called vapour-density is a mathematical fiction, without meaning in a physical sense: its interpretation is only possible when the vapour, at a point sufficiently above the boiling-point, obeys Mariotte's law, and possesses the constant coefficient of expansion of true gases, ·00367; then the density, reduced to 0° and 760 millimetres, is exactly that of a vapour at these points if it lost the property of condensation.—(*Comptes R.* lxiv. 237.)

Aniline Colours from Protein Compounds.—Dr. O. E. Erdmann. In August, 1866, Erdmann observed that some roast veal was superficially red; he succeeded in transferring some of the red matter to many substances, on which, favoured by moisture and an appropriate temperature, the red matter grew apace. The chemical relations of the colouring matter resemble those of triphenylrosaniline. The microscope showed that only the protein compounds were red, and that the accompanying clouds of infusoria were colourless; indeed, the study of cases of inoculation showed that multitudes of infusoria swarmed about the spot inoculated before any colour appeared; only after the red colour had spread over large surfaces did any mould appear, and this, when it appeared, arrested the progress of the infusoria. The colouring matter is probably produced by the infusoria in the same sense as alcohol, glycerin, &c., are produced by yeast. Researches of Haubener, Fuchs, Ehrenberg, and others on blue milk gave results closely analogous to those here described. An historical review of instances of "the bleeding Host," &c., commencing with the siege of Tyre by Alexander, 332 B.C., on which occasion a soldier's loaf suffered from hæmorrhage, is included in this paper.—(*Journ. prakt. Chem.* xcix. 385.)

Manganese, Cyanogen Compounds of (Mn = 55·14.)—R. Fittig. Manganic cyanide, dissolved in potassic cyanide solution diluted with alcohol, gives, on standing, a precipitate of small blue plates, decomposed by water, but crystallising from potassic cyanide solution in splendid dark blue transparent square tables, which should be quickly removed from the mother liquor, as they are very unstable. Their formula is $MnCy_2+4KCy$. Unalterable at 100°, they change at 200° to a brown substance. If alcohol be added to a solution of manganic cyanide in potassic cyanide which has been kept several days, or which has been boiled, a red precipitate is obtained identical with Rammelsberg's salt. The baric salt, corresponding to the first-mentioned potassic salt, separates in blue crystalline groups from a solution of manganic acetate mixed with excess of baric cyanide. It is insoluble in cold, and decomposed by boiling water.—(*Zeitschr. Chem.*, N. F., iii. 107.)

Bromtoluol, Action of Sodium on (C = 12).—R. Fittig. In this reaction, ditolyl is produced (*Zeitschr. Chem.*, N. F., ii. 312); also a small quantity of crystallisable hydrocarbon, supposed to be dibenzyl, but now found to be identical with Laurent's stilbene, called by Märcker and Limpricht toluylene. It crystallises in the form so characteristic of stilbene, melts at 119·5°, and has the formula $C_{14}H_{12}$. It probably arises from a secondary action, $4C_7H_7Br+4Na = C_{14}H_{12}+2C_7H_8$. Ditolyl seems to be identical with the hydrocarbon obtained by Limpricht by heating chlorbenzyl and water (*Zeitschr. Chem.*, N. F., ii. 280), in which reaction it appears that the chlorine of $C_6H_5(CH_2Cl)$ carries with it H_1 from the benzol residue, and the remaining $C_6H_4(CH_2)$ condenses and splits into anthracene and ditolyl.—(*Zeitschr. Chem.*, N. F., iii. 118.)

Mesitylene, Derivatives of (C = 12, O = 16).—R. Fittig. Monobrommesitylene, from direct action of bromine on mesitylene, is colourless, and boils without decomposition at 225°, sp. gr. 1·3191 at 10°; chromic or nitric acid oxidises it to brommesitylenic acid, $C_9H_9BrO_2$, crystallising from alcohol in powerfully refractive prisms, difficultly soluble in water. Dibrommesitylene, easily made from monobrommesitylene or from mesitylene, crystallises from alcohol in colourless needles, melting at 60°, boiling undecomposed at 285°. Tribrommesitylene, described by Hofmann, is more soluble in benzol than in alcohol, crystallises in needles, and melts at 224°. Nitromesitylene occurs in the preparation of mesitylenic acid, or in the action of nitric acid sp. gr. 1·38 on mesitylene; it is crystallisable from alcohol in large prisms, melting at 41°, boiling undecomposed between 235°—240°. Dinitromesitylene results from the action of fuming nitric acid on brommesitylene; almost insoluble in cold alcohol, it crystallises in colourless prisms from hot alcohol, and melts at 189°—190°. Amidomesitylene (mesidine), prepared by the sluggish action of tin and boiling chlorhydric acid on nitromesitylene, and separation by ammonia, is slightly soluble in boiling water, in which it melts to oily drops.—(*Zeitschr. Chem.*, N. F., iii. 102.)

Camphor, Action of Zincic Chloride on (C = 12).—R. Fittig. The reaction is not so simple as might be expected from Gerhardt's statement that a hydrocarbon of the composition of cymol is produced. After almost innumerable fractionations toluol and xylol were identified in the portion boiling below 150°; from the fraction boiling at 164°—167° tribrom- and trinitro-cumol were prepared identical with the corresponding derivatives of cumol from coal tar; the fraction between 173°—176° consists chiefly of a hydrocarbon probably identical with cymol from oil of cumin; from it a small quantity of tribromcumol identical with that before described, and a large quantity of a heavy oily brominetted body, were obtained; with chromic acid terephthalic and acetic acids were obtained. Between 185°—188° a hydrocarbon $C_{11}H_{16}$ homologous with benzol was obtained, boiling ultimately at 186°—187°, sp. gr. 887 at 10°, giving with bromine a body crystallising from alcohol in fine needles, probably $C_{11}H_{13}Br_3$, melting a little above 100°, and with nitric and sulphuric acids mixed a crystallisable trinitro compound, melting at 84°, soluble in hot alcohol; dilute nitric acid oxidised this hydrocarbon to an acid volatile in steam and forming an easily soluble baric salt which is crystallisable. Further reasearches on this acid are progressing.—(*Zeitschr. Chem.*, N. F., iii. 104.)

MISCELLANEOUS.

The Royal Society.—On Saturday evening, April 13, the President of the Royal Society held the second of his annual *soirées* at Burlington House. The attendance was not so numerous as on the former occasion, owing to the great number of scientific men who are now resident in Paris. Among things interesting to chemists we noticed a new form of ozone generator for decolorising sugar and other substances, exhibited by Mr. Edward Beanes,

F.C.S.; the aëlloscope, or storm-indicator, exhibited by the inventor, Mr. H. A. Clum; various forms of Dr. Richardson's apparatus for producing local anæsthesia, by Messrs. Krohne and Sesemann; a new self-registering railway-signal light, by Mr. W. W. Preece. Mr. H. C. Sorby, F.R.S., exhibited spectrum microscopes, with new improvements, and application in new directions; also, a direct vision hand spectrum telescope. Mr. J. Browning exhibited a silvered glass speculum 13 inches in diameter, micro-spectroscopes and illustrations, and 15 drawings of Mars taken during the recent apposition by the exhibitor. Messrs. Powell and Lealand exhibited patent binocular microscopes. A new form of air-pump for obtaining the most perfect exhaustion by mechanical means, by Mr. J. Barrett, was exhibited by Mr. Ladd. Mr. Ladd also exhibited a form of magneto-electric machine for the conversion of dynamic into electric force which he has lately invented. Dr. Gladstone exhibited absorption spectra as shown by liquids contained in hollow wedges. Professor Tennant exhibited specimens of precious stones and Derbyshire inlaying. Messrs. Troughton and Simms exhibited a spectroscope designed by Mr. W. Huggins, F.R.S.; a double image micrometer; and a 3-feet theodolite, the principal parts being made of aluminium bronze. Messrs. Cooke and Sons exhibited a portable and universal equatorial with telescope of 4-inch aperture, and a 12-inch transit circle with telescope of 2-inch aperture, arranged for use also in the prime vertical. Mr. Pulvermacher exhibited new batteries described as new volta-electric imperishable chain batteries, restorable in magnesium and zinc. Mr. E. J. Reed, of the Admiralty, exhibited models of iron ships, among them a rigged model of the Prussian iron-clad frigate *Wilhelm I.*, the most powerful ship yet laid down in any country. A vacuum tube (curious as a specimen of glass-blowing) for illustration of the electric discharge *in vacuo* was exhibited by Mr. E. Atkinson. Our readers will perceive that the list of objects exhibited included many novelties possessing great interest.

Sulphate of Manganese.—Wishing to make some of this salt, I adopted the following formula, which gives an abundant yield of the pure salt:—Introduce into an iron crucible a mixture of five parts of peroxide of manganese and three-fourth parts of coarsely powdered charcoal. Cover the crucible, and heat to redness until all the charcoal is consumed. Allow the contents of the crucible to cool, place in a porcelain dish, and add 6½ parts of sulphuric acid. Evaporate nearly to dryness, return the mass to the crucible, and heat to redness. When cool rub to powder, if necessary, and treat twice successively with eight parts of boiling water; mix the liquors, filter and evaporate until a pellicle begins to form, when set aside to crystallise. If evaporated too far an insoluble sulphate is deposited (probably in a peculiar state of hydration); hence care must be taken to remove it from the sand-bath as soon as a pellicle begins to form. When a good article of peroxide of manganese is used, this formula will give an abundant yield of perfectly pure sulphate of manganese. Any iron or copper present is destroyed by heating the crude salt to redness.—*C. L. Diehl, Am. Pharm. Assoc.*

Drilling Glass.—A ready and inexpensive mode of drilling glass slides may be of use to some of your numerous readers. Obtain a small three-sided saw file; grind the apex into a triangular sharp point—not too acute, as it will be apt to break if the steel is, as it should be, very hard—apply the sharp point of the file (previously wetted with turpentine) to the glass to be perforated, with firm pressure, keeping the point of the file in the same spot, and giving the upper part a motion from side to side, and also circular. The moment the surface of the glass is abraded the action will go on rapidly, keeping the point still wet with spirit of turpentine. When half way through, it is best to begin on the other side of the glass. When the aperture is made sufficiently large, it may be increased by using a small "rat-tailed" file, kept wet with the turpentine.—*J. B. Spencer, in Hardwicke's "Science Gossip."*

Notes on Testing the Purity of Glycerin.—I should regard a glycerin as unobjectionable for medicinal purposes, if it forms a colourless mixture with twice its volume of strong alcohol and of sulphuric acid; and if, after previous dilution with distilled water, it yields no turbidity, either cold or on heating to the boiling point with sulphuretted hydrogen, ferrocyanide of potassium, nitrate of baryta, oxalate of ammonia, or nitrate of silver. This last test I regard as an important one, since I believe that all those compounds, which impart to common glycerin a peculiar rancid odour, will reduce the silver salt and impart a colour to the liquid on boiling, even though that odour may be scarcely apparent, while pure glycerin is not affected by boiling with nitrate of silver, although, like nearly all organic and many inorganic compounds, it gradually assumes a darker colour on exposure to light.—*J. M. Maisch, in American Journal of Pharmacy.*

As cane-sugar syrup may be used as an adulterant, its presence may most satisfactorily be detected by diluting a little of the suspected glycerin with three parts of water, adding a few grains of tartaric acid, and boiling a few moments. Then add the solution of sulphate of copper, followed by the potassa, when the reddish suboxide will at once appear, if cane sugar had been present, the tartaric acid having changed the cane sugar into glucose.—*W. Proctor, in American Journal of Pharmacy.*

ANSWERS TO CORRESPONDENTS.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. 0d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

J. W. Swindells.—Received with thanks.

A Chemical Novice.—The article on "Sulphate of Magnesia" in last week's Chemical News will doubtless afford all the information required.

D. Waldie, Calcutta.—The letter and book packet have arrived safely. The report on the water supply is of considerable value, and we will take an early opportunity of returning to the subject.

Torelli's Ice Machine.—*T. P. Hawksley.*—We are not aware that the machine can be obtained in this country. Apply to the makers in Paris.

Cement.—In the receipt for alum and plaster cement, given a few numbers ago, it should have been mentioned that the alum should be melted over a fire, and the plaster of Paris then added in sufficient quantity to form a paste.

Red Liquor.—*J. W.*—In reply to a question on this subject in last week's Chemical News, a correspondent has kindly informed us that the colouring matter of commercial red liquor (acetate of alumina) is generally peach or brazil wood.

Acetonitrate of Bismuth.—J. Wallace wishes to know how to make the above so as not to precipitate on the addition of water. We are not aware that acetic acid will prevent the precipitation of bismuth salts on addition of water. Citric acid is generally used for that purpose.

Jesse Fisher.—The sample of tetrachloride of carbon arrived safely. It appears to be almost chemically pure. At present the demand for the article is limited; its commercial uses have to be found out. Probably in this, as in many other instances, the supply will create a demand.

A Chemical Novice.—1. Add chloride of ammonium to the impure sulphate of magnesia, then ammonia, and boil; the iron will be precipitated in the state of sesquioxide. If you want to ascertain the exact quantity present, this precipitate can be collected on a filter, ignited with the usual precautions, and weighed.—2. Perhaps the best plan for ascertaining the value of magnesian limestone would be to find out how much sulphate of magnesia you could make from a certain weight, say 7 lbs.—3. If you find the presence of iron interfere with the product, you may, perhaps, prevent the sulphate of iron crystallising with the sulphate of magnesia by peroxidising the iron with nitric acid. This will convert the iron into a persulphate which is not readily crystallisable.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Stability of Gun-cotton, by* F. A. Abel, *F.R.S., V.P.C.S.*

It has been shown in the memoir "*On the Manufacture and Composition of Gun-cotton*," published last year,† that modifications in the processes of conversion and purification, which appear at first sight of very trifling nature, exert most important influences upon the composition and purity of the product.

Very numerous and extensive experiments and observations have been carried on during the last four years at Woolwich, both with small and large quantities of gun-cotton, for the purpose of completely investigating the conditions by which the stability of this substance, when under the influence of light and heat, may be modified, and with a view to ascertain whether results recently arrived at in France apply to gun-cotton as manufactured in this country.

The principal points which have been established by the results arrived at in these investigations may be summed up as follows:—

1. Gun-cotton produced from properly purified cotton, according to the directions given by Von Lenk, may be exposed to diffused daylight either in open air or in closed vessels for very long periods without undergoing any change. The preservation of the material for three and a half years under those conditions has been perfect.

2. Long-continued exposure of the substance in a condition of ordinary dryness to strong daylight and sunlight, produces a very gradual change in gun-cotton of the description defined above; and the statements which have been published regarding the very rapid decomposition of gun-cotton when exposed to sunlight do, therefore, not apply to the nearly pure trinitrocellulose obtained by strictly following the system of manufacture now adopted.

3. If gun-cotton in closed vessels is left for protracted periods exposed to strong daylight or sunlight in a moist or damp condition, it is affected to a somewhat greater extent; but even under these circumstances the change produced in the gun-cotton by several months' exposure is of a very trifling nature.

4. Gun-cotton which is exposed to sunlight until a faint acid reaction has become developed, and is then immediately afterwards packed into boxes which are tightly closed, does not undergo any change during subsequent storage for long periods. (The present experience on this head extends over three and a half years.)

5. Gun-cotton prepared and purified according to the prescribed system, and stored in the ordinary dry condition, does not furnish any indication of alteration beyond the development, shortly after it is first packed, of a slight peculiar odour, and the power of gradually imparting to litmus, when packed with it, a pink tinge.

6. The influence exercised upon the stability of gun-cotton of average quality, as obtained by strict adherence to Von Lenk's system of manufacture, by prolonged exposure to temperatures considerably exceeding those which are experienced in tropical climates, is very trifling in comparison with the results recently published by Continental experimenters relating to the effects of heat upon gun-cotton, and it may be so perfectly counteracted by very simple means, which in no way interfere with the essential qualities of the material, that the storage and transport of gun-cotton presents no greater danger, and is, under some circumstances, attended with much less risk of accident than is the case with gunpowder.

7. Perfectly pure gun-cotton, or trinitrocellulose, resists to a remarkable extent the destructive effects of prolonged exposure to temperatures even approaching 100° C., and the lower nitro-products of cellulose (soluble gun-cotton) are at any rate not more prone to alteration when pure. The incomplete conversion of cotton into the most explosive products does, therefore, not of necessity result in the production of a less perfectly permanent compound than that obtained by the most perfect action of the acid mixture.

8. But all ordinary products of manufacture contain small proportions of organic (nitrogenised) impurities of comparatively unstable properties, which have been formed by the action of nitric acid upon foreign matters retained by the cotton fibre, and which are not completely separated by the ordinary or even a more searching process of purification.

It is the presence of this class of impurity in gun-cotton which first gives rise to the development of free acid when the substance is exposed to the action of heat; and it is the acid thus generated which eventually exerts a destructive action upon the cellulose products, and thus establishes decomposition, which heat materially accelerates. If this small quantity of acid developed from the impurity in question be neutralised as it becomes nascent no injurious action upon the gun-cotton results, and a great promoting cause of the decomposition of gun-cotton by heat is removed. This result is readily obtained by uniformly distributing through gun-cotton a small proportion of a carbonate; the sodic carbonate, applied in the form of solution, being best adapted to this purpose.‡

9. The introduction into the finished gun-cotton of 1 per cent. of sodic carbonate affords to the material the power of resisting any serious change, even when exposed to such elevated temperatures as would induce some decomposition in the perfectly pure cellulose products. That proportion affords, therefore, security to gun-cotton against any destructive effects of the highest temperatures to which it is likely to be exposed even under very exceptional climatic conditions. The only influences which the addition of that amount of carbonate to gun-cotton might exert upon its properties as an explosive would consist in a trifling addition to the small amount of smoke attending its combustion, and in a slight retardation of its explosion, neither of which could be regarded as results detrimental to the probable value of the material.

10. Water acts as a most perfect protection to gun-cotton (except when it is exposed for long periods to sunlight), even under extremely severe conditions of exposure to heat. An atmosphere saturated with aqueous vapour suffices to protect it from change at elevated temperatures, and wet or damp gun-cotton may be exposed for long periods in confined spaces to 100° C. without sustaining any change.

Actual immersion in water is not necessary for the

* Abstract of a paper read before the Royal Society, April 4, 1867.

† *Trans. Royal Society.*

‡ The deposition of calcic and magnesian carbonates upon the fibre of gun-cotton, either by its long-continued immersion in flowing spring water or by its subjection to the so-called "silicating" process adopted by Von Lenk, exerts a similar protective effect, which, however, is necessarily very variable in its extent, as the amount of carbonate thus introduced into a mass of gun-cotton is uncertain; moreover, as it is only loosely deposited between the fibre, the proportion is liable to be diminished by any manipulation to which the gun-cotton may be subject.

most perfect preservation of gun-cotton; the material, if only damp to the touch, sustains not the smallest change, even if closely packed in large quantities. The organic impurities, which doubtless give rise to the very slight development of acid observed when gun-cotton is closely packed in the dry condition, appear equally protected by the water; for damp or wet gun-cotton, which has been preserved for three years, has not exhibited the faintest acidity. If as much water as possible be expelled from wet gun-cotton by the centrifugal extractor, it is obtained in a condition in which, though only damp to the touch, it is perfectly non-explosive; the water thus left in the material is sufficient to act as a perfect protection, and consequently also to guard against all risk of accident. It is therefore in this condition that all reserved stores of the substance should be preserved, or that it should be transported in large quantities to very distant places. If the proper proportion of sodic carbonate be dissolved in the water with which the gun-cotton is originally saturated for the purpose of obtaining it in this non-explosive form, the material, whenever it is dried for conversion into cartridges or employment in other ways, will contain the alkaline matter required for its safe storage and use in the dry condition in all climates.

On the Action of Permanganate of Potassium on certain Metals, by W. B. GILES.*

THE powerful action which a cold saturated solution of permanganate of potassium exerts upon metallic mercury has not been previously noticed, as far as I am aware; a short account of this reaction may, therefore, be acceptable.

On examining the action of this salt on some other metals, I was surprised to find that zinc, which oxidises so readily under ordinary circumstances, is apparently not in the least degree attacked by the solution—in fact, rods of the pure metal may be kept in a bottle with the solution for two months without any perceptible change occurring. Mercury, however, which is generally classed with gold and silver as a metal somewhat difficult to oxidise, is most readily and completely converted into mercurous oxide in a short time. An ounce or so of mercury may be enclosed in a stoppered bottle with a solution of permanganate saturated at the ordinary temperature. If the bottle is violently shaken, the metal will immediately become disintegrated, and will appear as a powder, each minute globule of metal being coated with a film of oxide, which prevents its reunion with the rest. If the bottle be incessantly shaken, the solution will be deprived of all colour in a short time; but even if the bottle be left at rest, and only an occasional shake be given, the change will be complete in about twenty-four hours. The action is, of course, much retarded by the clogging nature of the manganic oxide on the metal. The colourless fluid, when all the action is over, is strongly alkaline, and contains free hydrate of potassium; and if the permanganate be renewed as often as it is decolorised, there is no difficulty in oxidising the whole of the mercury. The ensuing dark-brown powder is easily resolved by elutriation into brown manganic oxide and black mercurous oxide, in consequence of the great difference in their specific gravity. The oxide so obtained is in all respects similar to that obtained by the ordinary methods. A curious intermediate stage of the oxidation is noticed towards the end of the experiment. The permanganate is not directly deoxidised, but first passes to manganate—the colour, of course, changing from purple to bright green. The action is much more rapid if the mercury and the permanganate are boiled together; in this case, however, a certain amount of mercuric oxide appears to be formed, and the change to manganate is not observed.

This salt also appears to exert a slight action on pure silver, but the few trials I have made have given me rather anomalous results, some pieces of silver being apparently superficially oxidised, whilst others were not acted upon.

The solution has no action upon copper, not even when kept at 100° C. for several hours. It would be interesting to know if this salt has any action on magnesium and thallium, both being metals prone to oxidation.

40, Highfield Street, Liverpool.

[Neither aluminium nor magnesium exerts any apparent action on dilute permanganate of potassium in the cold. After long ebullition a deposit of brown oxide of manganese is formed, but the solution is not decolorised unless excessively weak. Thallium exerts a more powerful action, and, even in the cold, gradually decomposes the permanganate.—ED. *C. N.*]

On the Preparation of Pure Distilled Water, by J. STAS.

IN my "*Recherches sur les Rapports Réciproques des Poids Atomiques*,"* I showed the means I employed to procure pure distilled water for my experiments. The best method of destroying volatile organic matter liable to become fixed either spontaneously or under the influence of the mineral acids, is, as I stated, to pass the vapour of water slowly through a long tube of red-hot copper bent in a zigzag form, filled with roasted copper turnings, and heated to bright redness in a furnace, and to distil a second time the water condensed from this vapour, using a platinum refrigerator. This method, which is perfect as far as regards the quality of the product, is not quite satisfactory when large quantities of pure water are wanted, as was the case for my present researches. In fact, the passage of the vapour through the red-hot copper tube causes a sufficient lowering of the temperature to prevent the oxide of copper acting upon the organic matter, if the current of vapour is a little too rapid. It is necessary, therefore, to distil very slowly. This inconvenience determined me to find a quicker method. This I succeeded in doing by using a mixture of manganate and permanganate of potassium to destroy the organic matter. The following is the way in which I obtained, by this method, the very considerable quantities of pure water that I required for my researches. I prepared manganate of potassium by the action of hydrate and chlorate of potassium on binoxide of manganese. The pulverised product was mixed with the smallest quantity of water necessary to dissolve the whole of the manganate formed, and the mixture left at rest in a closed vessel. Four or five per cent. of the solution, which had become clear and of a deep green colour, was added to the water to be distilled, and the mixture left to react for four-and-twenty hours. I also put in the retort a litre or two of a concentrated solution of manganate of potassium, with an equal volume of a solution of hydrate of

* Communicated by the author.

* See CHEMICAL NEWS, iv. 207.

potassium sufficiently concentrated to give stability to the salt and to enable its dilute solution to resist for a longer time the action of the heat without decomposing. I then filled the retort about eight-tenths full of the water which had been acted upon by the manganate of potassium, and proceeded to distil it in the usual way.

When it boiled the fire was slackened to avoid carrying over the liquid, which, for some moments, produces a somewhat abundant frothing. When this is over the water may be boiled freely without any inconvenience. After about the first twentieth of the water has passed over as vapour, the latter is quite free from organic matter, and even from inorganic matter, if the tube is furnished with diaphragms for arresting the small drops of liquid always carried over by brisk boiling. In this way a person used to such distillation may produce *at once* water in which it is impossible to discover the slightest trace of organic matter or of the fixed matter existing in the retort. Nevertheless, when I required water quite free from matter, either fixed or capable of becoming so, I took care to submit the water to a fresh distillation, taking the precaution of using as refrigerator a long platinum tube soldered with gold; generally, also, the water, as it was condensed, was used in the washing for which it was required.

I should add that, having sometimes used *rain* instead of spring water to procure pure distilled water from, by means of manganate of potassium, I found sensible quantities of ammonia in the condensed water, which proves that the manganate does not destroy that base. It is, then, indispensable to submit the water to a fresh distillation, with some thousandths of monosodic or monopotassic sulphate.

I will not here refer to the properties which pure water ought to have, nor to the means of ascertaining its purity. I have entered sufficiently upon these subjects in the work mentioned at the beginning of this article, to which I refer those who may wish for more details on this subject.

PHARMACY, TOXICOLOGY, &c.

The New Pharmacopœia (1867).

[FOURTH NOTICE.]

Carbolic acid has a complete set of tests supplied for its identification, and as no process is given for making it, we presume that the purest commercial acid is considered trustworthy. Sulphate of atropia, with an officinal solution, is a great acquisition to the list of the mydriatic remedies, so called from their pupil-dilating powers. The value of these topical agents is so undeniable and demonstrated so readily, that a perfect series of them is greatly to be desired, and the history of them is very instructive. Thus, it was found that belladonna caused the pupil to dilate, while contraction was induced by opium—a topical effect indicative of a general special nervous influence. The problem was to separate these, and, by the next step in the discovery, the alkaloids of the respective drugs were tried. Atropia acted topically as a mydriatic, but morphia did not possess a similarly local myosotic power. This was the stage reached by the last British Pharmacopœia; two steps further have been now taken. Atropia is replaced by the less irritating sulphate, and so that series is quite complete; the converse series is continued, but not concluded, for Calabar bean is now officinal, which has a local pupil-contracting power without producing constitutional effects (as does morphia), and so is the converse of atropia. We should have been glad if the group had been completed by the introduction of physostigmine—the alkaloid itself being slightly, the sulphate, chloride, &c., more readily, soluble in water.

Apart from this, the alkaloid of Calabar bean has had a very searching investigation by foreign physiologists, and English authorities on cerebro-spinal disorders have used it very extensively. Moreover, it has been prepared in a state of purity by many London manufacturing firms, that of Messrs. Hopkins and Williams being, we believe, one of the first. If these additions had been made, we should have had a model group of nervous local agents, each counteracting the other—a group whose powers are more unequivocal than those of any other in pharmacy. For instance, as regards effects—

Mydriatics.		Myosotics.	
Constitutional.	*Local.*	*Constitutional.*	*Local.*
Belladonna.	Belladonna.	Opium. Physostigma.	Physostigma.
Atropia.	Atropia.	Physostigmine. Morphia.	Physostigmine.
Sulphate of atropia.	Sulphate of atropia.	Acetate of morphia.	Sulph. of physostigmine.

The bismuth additions are two in number, and we are glad of it, for being a dyspeptic remedy, like iron, we cannot have too many preparations of it, some of such compounds being more easily taken in some conditions, and *vice versâ*.

Iodide of cadmium was first recommended by Dr. Garrod to replace iodide of lead in ointment, a favourite remedy of some, on the grounds that the former, unlike the latter, does not stain the skin yellow, and never induces any constitutional symptoms with the same therapeutic effect. The Pharmacopœia Committee, being above prejudice, give both ointments.

Oxalate of cerium has been found specially useful by some in cases of obstinate vomiting, but this special effect has been quite as frequently denied.

Citrate of ammonia seems very similar in all respects to the acetate, and is restored from the London Pharmacopœia 1851. Effervescing solution of potash reappears from the Pharmacopœia of 1836; seemingly it has not been much missed for thirty years.

Iodide of sulphur, also, is a revived remedy not used internally. The number of lithia preparations has been increased in spite of their rapid falling out of use, although theoretically they promised so well as solvents for some kinds of calculus.

Thus, then, we have noted very briefly the general features of the new work, alluding chiefly to the novelties. A very great concession is made to the grumblers at the last edition by references to the preparations which were contained in it, taken either from the Dublin, Edinburgh, or London Pharmacopœia, with the name only slightly altered. The names of the first edition of the British Pharmacopœia are in most instances retained, but a note here and there tells us what the former name was, and in what way the strength or ingredients of mixtures, &c., have been altered.

The publication of the volume at one uniform price is positively to be delayed no longer. Many as have been the delays, no one will complain if opportunities have been taken up to the latest moment of making it an authoritative book worthy of the British Medical Council. An advertisement has been inserted in the medical papers of a speedy issue of copies, and before another week has passed the British Pharmacopœia of 1864 will be an authority no more.

The present, then, is a fitting time for a short comparison of the two editions. The Pharmacopœia of 1867 is certainly an honest book. It contains good preparations laboriously selected from many sources—from Continental works of the kind, but mainly from the London, Edinburgh, and Dublin Pharmacopœias, the French Codex slightly, with the edition of 1864 for its basis. It has been spoken of favourably on all hands, and its merits must be considerable if we may judge from the different quarters in which its praises have been proclaimed. All say that it is a cheap, good, and practical book.

But the fact has been forgotten that such a success was only possible after a preparation for it, and the way was cleared by the 1864 edition—crude, and approved of only by its framers. The 1864 edition cost a sum of money altogether out of proportion to its value; it was incomplete, it contained too many novelties. All this may be true, but it is a book that will in future times be pointed to with pride as the first national Pharmacopœia in the English language which established a uniform and satisfactory system of weights and measures, and was, after all, a signal triumph over old prejudices and errors. All will be glad of the new edition, but all should try and do justice to the old, which remains a monument of a critical time in modern medicine.

Solution of Meconate of Morphia, by William Procter, *Jr.*

The following working process for preparing this solution is suggested:—

Take of

Opium in powder (or dry enough to powder) 5 troy-ounces,
Stronger alcohol (95 per cent.) a pint,
Distilled water,
Water,
Acetate of lead,
Water of ammonia, of each a sufficient quantity,
Ingredients for generating sulphuretted hydrogen a sufficient quantity.

Macerate the opium in a pint of water with agitation for three days, strain with expression, and again macerate in successive portions of water, a pint each time, for twenty-four hours, until four pints have been used and the opium sufficiently exhausted. Evaporate the liquors carefully to the measure of a pint, filter and add solution of acetate of lead until it ceases to produce a precipitate. Collect this on a filter, wash it with water thoroughly, suspend it in a pint of warm distilled water, pass a current of sulphuretted hydrogen through the mixture until the lead is entirely precipitated, heat and filter the solution of meconic acid that remains, until deprived of sulphuretted odour. Meanwhile, take the liquid filtered from the lead precipitate (containing the morphia, &c.), together with the washings, evaporate them at a gentle heat to four fluid ounces; drop in sufficient diluted sulphuric acid to precipitate the oxide of lead present, and filter; then mix the filtrate with an equal bulk of alcohol, and carefully add the solution of ammonia, with agitation, until it remains in slight excess, allowing it to rest twenty-four hours that the morphia may separate. Collect the impure morphia on a filter, wash it with a little water, and dissolve it in the hot solution of meconic acid, and filter if necessary, washing the filter with a little distilled water. Finally, add first sufficient distilled water to the filtrate to make it measure three pints, and then the stronger alcohol, and mix them.

Thus made, solution of meconate of morphia has a decided bitter taste, but little odour except from the alcohol present, and a light reddish-brown colour, varying in different specimens, and due to adhering colouring matter, and especially to contact with oxide of iron during preparation in filters or utensils.—*American Journal of Pharmacy.*

Pharmacy of the late American War.

Many are the lessons taught by the late civil war in America, but we think that its magnitude is altogether inappreciable, even by the amount of a national debt incurred in such a short space of time. We propose to take another stand-point for estimating this magnitude, with the assistance of the lately published proceedings of the American Pharmaceutical Association. We must premise that, owing to many pressing reasons, chiefly from the inferiority of the drugs, and the high price charged by the contractors for the army medical service, the Government was induced by the Surgeon-General to form pharmaceutical laboratories at the commencement of the year 1863. Two large laboratories were built, one at Philadelphia, the other near New York, and statistics are given for the information of all who take interest in pharmacy on a large scale.

Before giving a short notice of this laboratory at Philadelphia, we must mention that the quantities given were used by one of the two belligerent parties during about half the time of the war, and issued from one only of the two laboratories.

The quantities of drugs taken and bandages used, therefore, during the whole time of the war would certainly be underrated if those given were multiplied fourfold.

The labour at this Philadelphia laboratory was commenced by a force of three young ladies, we are told, by the manufacture of bedclothes, towels, drawers, and shirts. In a short time the work was increased to such an extent that seventy-two sewing-machines and some 250 "hands" were pressed into service.

It is said that a full detail of the internal arrangements and work done would require too much labour, from the materials for such a report being so scattered, and so they will be for ever lost. We very much regret this, as many more pretending reports issued from America do not possess a tithe of the value that such a valuable chapter of medical history would possess.

Attached to the building were a counting-house, shipping, receiving, and packing departments, a glassware department, another for tin cases and boxes, washhouse, stoppering room, steam boilers and engines, and an analytical room.

For converting the crude drugs into the chemical and pharmaceutical products needed, were provided—1st. A mill-room for pulverising (coarsely or finely) and drying. 2nd. A still-room, for the preparations for which steam could be used. 3rd. A furnace-room. 4th. An ether house. A separate building for the manufacture of chloroform and ether. 5th. A filling department in which female hands only were engaged, and with which the manufacture of isinglass plaster, pills, and bandages was connected.

When the work was commenced, a large stock of substances afterwards provided from the laboratory, already existed; besides, medical purveyors bought much from the market afterwards. So an accurate estimation of what was really consumed cannot be given.

Of course there was much interested opposition to the working of this scheme.

And now "to count our gains," bearing in mind the limitations before given. From March, 1863, to September 30, 1865, were actually isssued from the large Philadelphia Laboratory of Pharmacy, &c., 2,318,928 roller bandages, 34,465 yards of isinglass plaster, "alcohol fortius" 141,436 quarts, precisely 3,175,248 opium pills, and 1,292,232 pills, containing each three grains of sulphate of quinine. 6645 lbs. of opium were used in powder, and a quantity of all the following drugs was issued, in every case exceeding 10,000 lbs. by weight. We arrange them in order of quantities, not to serve as an estimate of what drugs were most frequently used, for such would be very fallacious, as a dose of one compound might be a drachm, of another a few grains; but, with this allowed, a fair notion may be given of the general order in the use of the several drugs.

As might be almost expected from the largeness of the dose and general utility, old-fashioned Epsom salts carries off the palm. The quantity of sulphate of magnesia used was 62,611 lbs.; the next highest number is given for linseedmeal—viz., 55,627 lbs.—followed closely by simple ointment, 50,097 lbs. These numbers are by far the highest; the next to them in order are *sinapis nigræ pulvis*, 31,429 lbs.; *syrupus scillæ*, 29,863 lbs.; solution of chlorinated soda, 26,936 lbs.; chloroform, 25,300 lbs.; spirits of nitrous ether, 21,834 lbs.; and so we might prolong the list to some length.

We may observe, as curiosities of pharmacy, during a severe civil war, the issue of 10,594 lbs. of black pepper, 10,257 lbs. of powdered gum arabic, 14,029 lbs. of copaiba balsam, and 3391 lbs. of sulphur.

Ether in America largely replaces chloroform as an anæsthetical remedy, and so we are not unduly surprised at the amount of 16,308 lbs. prepared.

These figures are rather hard to realise as the requirements of a medical department during time of war, for little more than two years and a half, from one establishment. We can only give the statistics presented to the eminent members of the Pharmaceutical Association of America, which has on its roll many of the leading medical names of the United States. These wholesale results tend to show that at critical times in a nation's history a demand has only to exist for the greatest efforts to be made. After the whole of the expenses were paid, the saving to the Government was found to be $766,019·91.

On the Estimation of Phosphoric Acid in the Presence of Alumina.—M. Knap attempted to estimate phosphoric acid in a mineral rich in alumina, by the process founded on the non-precipitation of alumina and ferric oxide by ammonia in the presence of tartaric acid, and obtained no precipitate with sulphate of magnesia, although the presence of phosphoric acid was shown by molybdic acid. To ascertain the cause of this, the author operated on a liquid containing phosphate of alumina, and on another containing ferric phosphate; to them was added tartaric acid, then ammonia, and afterwards sulphate of magnesia; that containing phosphate of iron, at once gave a precipitate containing ammoniaco-magnesian phosphate, whilst the other remained limpid even after several days' exposure in a warm place. Thus the presence of alumina renders the estimation of phosphoric acid impossible by the process in question, for it retains this acid, even whilst dissolved in an alkaline liquid.—*Zeitschrift für Chemie*, ii. 151.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, April 24, 1867.

On the demand presented in the name of the French Society of Photography by MM. Regnault and Peligot, the Commission of Coins and Medals has engraved a commemorative medal of the discoveries of Niépce and Daguerre. One of the dies of these medals is to serve as a type for those given as rewards by the Society; and the latter was disposed to engrave at its expense a special die for the reverse, when one of the members of the Council, M. Hulot, director of the manufactory of postage-stamps at the Mint, proposed to engrave it at his own expense, and to place it at the disposition of the Society. M. Hulot, also, struck with the importance of the labours and discoveries of the competitors for the prize of the Duke de Luynes, given to M. Poitevin, has offered to have struck six great medals, to be given to six of the most worthy rivals of the fortunate winner of the prize of 8000 francs. The new and brilliant industry of postage stamps which he furnishes for the Government have enriched M. Hulot, whose generosity increases with his fortune. It is impossible to make a better use of what he has gained by talent and energy.

M. Dubrunfaut has recently made a very important discovery—the presence in Jerusalem artichokes of a large proportion of cane-sugar. This discovery was made ten years ago, but it required to be confirmed by new experiments, which the illustrious chemist could only make this year. The juice of the tubers dug up in September has a vigorous rotatory left-handed motion. Under the influence of yeast it acquires an incomplete alcoholic fermentation, takes the form of a curded mass, and gives a powdery precipitate of well-characterised inuline; the liquid separated from the precipitate, and treated with alcohol, gives a new precipitate of inuline. The juice of the tubers dug up in March or April has a rotatory motion towards the right, and gives no precipitate of inuline either spontaneously or with alcohol; submitted to fermentation it furnishes by distillation the enormous quantity of 8 or 9 per cent. of concentrated alcohol; and treated with alcohol at 92° to 93° to saturation, it gives two products — 1st, an alcoholic solution; 2nd, a gummy precipitate insoluble in alcohol, but quite soluble in water. This solution is optically neutral, and can undergo an alcoholic transformation without losing its neutrality.

F. Moigno.

Iridium in Canada.—The *Keystone News*, March 1, says:—"Mr. Meves, of Madoc, states that iridium exists along with the other materials with which gold has been found in the Richardson mine. The presence of iridium is not mentioned in the reports of Dr. Hunt and Mr. Michel; but as Mr. Meves has obtained his specimens quite recently, they may have been taken from different parts of the vein or "pocket," as this deposit has been called. Iridium is one of the rare metals, and is of extreme hardness. It was found in Californian gold, and its presence in the gold coined at the United States mint caused the destruction of several valuable dies, and from this led to its detection and removal. The same substance is found in the gold of the Chaudiere, as also platinum, and an alloy of osmium and iridium, named iridosmine. The latter is very hard and durable, and is put to a practical use in pointing gold pens and in jewelling. Platinum, it need scarcely be remarked, is a most valuable metal, and if found in the gold region here, as is quite likely, would constitute of itself a valuable discovery. We mention this to encourage explorers to have their eyes open to other things besides gold. Such a tract of country might also be expected to supply precious stones, as chalcedony, amethysts, and other varieties of coloured quartz, jaspers, and even diamonds."

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

M. Richter, of Friburg, exhibits two ingots of perfectly pure indium. This metal, the last of those discovered, is rare enough to cost 36 fr. the gramme. The two bars weigh about 500 grammes, and therefore represent a sum of 18,000 fr. There is a great resemblance between indium and cadmium, especially in their chemical nature; also it is difficult to distinguish or separate one from the other. The only tangible difference is that the oxide of indium is insoluble in ammonia. Indium is as white as tin or cadmium; it is volatile, and has a peculiar odour; its spectrum is remarkable for its bright indigo line—hence its name. The indium of the Paris Exhibition of 1867 is the king of chemical products, as thallium was in 1862. But M. Richter has no rival claimant for the honour of the discovery of indium, and is to have a gold medal.

Near this case M. Vée exhibits some products altogether new—viz., eserine, and the preparations of the calabar bean. Eserine, the principal active matter of this bean, first eliminated by the above-named gentleman, is a crystallisable alkaloid, different from the *physostygmine* discovered by M. Jobst and Hesse of Stuttgard. A hundredth part of a centigramme introduced under the eyelids is sufficient to produce a sensible action. M. Vée delivers to the commercial world discs of gelatine containing the twenty-fifth of a milligramme of eserine, granules of eserine for internal use, a glycerate of sulphate of eserine for collyria, discs of gelatine containing the twenty-fifth part of a milligramme of sulphate of atropine, in order to produce the dilatation of the pupil—an effect opposite to that of discs of eserine. His calcined magnesia, and preparations of magnesia, hydrated magnesia, heavy calcined magnesia (produced by burning the hydrate), magnesium mixture (a fluid preparation containing a tenth of its weight of hydrated magnesia), his effervescing magnesia lemonade, have been well developed in France, Austria, and England.

M. François Cerio, owner of the gastronomic establishment at Turin, exhibits a method of preserving meat, flesh of all sorts, vegetables and fruits, and in general all substances usually treated by salt or saltpetre. This is so simple and efficacious that we are astonished it was not discovered and put in practice earlier. The machine consists of a receiver, able to preserve a vacuum when closed by a cover also impenetrable to the air. It is furnished at the top with two pipes, with stop-cocks communicating one with the exhausting machine, the other with a vessel containing a solution of common salt (with the addition of 2 to 5 per cent. of nitrate of potash or saltpetre, if the meat is required to take a high colour). The cover being removed, the substance to be preserved is inserted; the vessel is then closed tightly, and the cock communicating with the exhauster is opened, and the vacuum is made, if possible, down to five millimetres' pressure. The exhausting cock is then shut, and the brine cock is opened; the salt liquor is allowed to remain in contact with the substance to be preserved for a certain time, depending upon its mass, which never exceeds a few minutes. The substance is then removed and hung up to drain in a well-aired place; after a few days it is dry, and fit for putting in a case for sending off to any distance.

Let me remark that, in proportion as the expansion proceeds, the food to be preserved swells up and increases in volume one-third more than its original bulk. It is on account of this considerable opening of the pores or void spaces that the alimentary substance placed in contact with the saline liquors absorbs the necessary quantity for its preservation, if not indefinitely, at least long enough to warrant its expedition for a long voyage.

Thus treated, the substance preserved loses absolutely none of its nutritive elements—fibrin, albumen, creatin, &c. It loses its colour by drying, but the interior preserves the fresh tint, odour, and taste peculiar to it. When cooked, it retains very slight traces of salt. I can affirm that, by this mode of preparation, the substances prepared keep all their natural properties and qualities, and are able to replace, without inconvenience, fresh food.

It may certainly happen that, after having remained for some time packed in a case, they may acquire somewhat of an odour; yet this is only superficial, which goes off by exposure to air, and disappears entirely by being steeped for a few hours in water. I have seen a carp weighing 5 to 7 kilogrammes that M. Cerio brought from Turin, and which was exhibited, among other specimens, at the Society of Encouragement at the last sitting. This invention presents the following advantages:—

1. Immense saving of time, since it requires only a few minutes for complete preservation, instead of several days, and sometimes months.

2. The possibility of operating at all times, no matter under what atmospheric circumstances, while the ordinary salting methods are injuriously affected by certain states of pressure and humidity of the air.

3. Economy of salt and saltpetre in the very great proportion of 80 per cent.

4. Imperceptible waste of the substance; whilst under ordinary processes the preserved food loses a considerable proportion of nutritive element.

5. Absolutely certain success, whilst the old processes give imperfect results.

6. Preserving food in a degree superior in quality and soundness.

The machines or apparatus of exhaustion, furnished with a free piston in the same manner as the air-pumps of M. Deleuil, seem to have been specially invented for the purpose of rendering possible the practice on a large scale of the process of M. Cerio. The inventor declares that he is able to deliver any quantity of meat that can be henceforth required for either the armies or navies of France or England, and that he will prepare it at the markets of Italy or France, or at the immensely abundant markets of Paraguay, the Pampas, Texas, &c., where meat costs almost nothing. His discovery is certainly one of the most important of the Exhibition of 1867, and I can warmly applaud it.

In Group VI., Classes 45, 21, is exhibited the apparatus for the manufacture of sugar by osmose. This apparatus is called the osmogene. In the *Mondes* of August 11, 1864, were described some experiments in the factory of Courrières, near Valenciennes, of an osmogene apparatus that M. Dubrunfaut, the celebrated French manufacturing chemist, had patented in June, 1863, with a view of removing, by endosomose or osmose, from molasses or juice, the salts which they contain, and which prevented the crystallisation of the sugar.

Now facts have brought to light the real state of the process, MM. Camichel and Co., sugar manufacturers and distillers, at La Tour-du-Pin, exhibit the results obtained during the seasons 1864, 1865, and 1866.

Each osmogenic apparatus requires a space of 1 m. 35 c. height, 1 m. 12 c. long, and 1 m. 32 c. wide, besides the height required for the distributing vessels for water and molasses. It includes 50 or 60 frames, forming partitions one centimetre thick, and containing small bars and cords to support the sheets of parchment paper necessary for the work. The water frames alternate with those of the molasses or syrups. Each frame is pierced by two openings in the interior, giving passage, one to hot water, the other to the syrup, so that, from two contiguous partitions, water is obtained from one, and syrup from the other. The two liquids start from a height of one metre, arrive at the base of the apparatus, and ascend, in order to leave the higher orifice at a temperature of 70° to 80° C. They can also circulate in a contrary direction.

The water is introduced and regulated in such a manner

as to serve for the degree of refining required. Among the results obtained are the following:—

1st. The beetroot liquors treated by these apparatus having yielded results pure enough to be employed in place of water in the melting of raw sugars for refining, one can easily understand the advantage of a like substitution—economy of fuel and direct conversion of the syrup into refined sugar, for the greater part of the products of the beetroot.

2nd. For the syrups of the second drawing the improvement has been more extraordinary; they have given constantly 8 to 10 per cent. of very fine and good sugar, more than the syrups obtained without osmose, and the baking is more easy.

3rd. The syrups of the third drawing, baked without being either filtered or reosmosed, put in the cisterns, and submitted to the action of the turbine, give products of the first quality when taken to the baking oven.

4th. The syrups of these third drawings osmosed give 25 per cent. of their weight of excellent sugar by the turbine, while those not osmosed only render 10 or 12 per cent. of black and pasty sugar.

5th. Lastly, the molasses of the fourth drawings, formerly sent for distillation or used in the manufacture of sugar, are treated now by osmose, and yield from 16 to 18 per cent. of their weight of sugar, No. 10; if they are reosmosed, placed in cisterns, and treated at the proper moment, as much as 10 or 12 per cent. of good sugar can be yet obtained.

The machinery is stopped every second day for washing the interior of the apparatus—first with hydrochloric acid, afterwards with a jet of steam, first applied at La Tour-du-Pin by the advice of the inventor, M. Dubrunfaut. This operation takes about four or five hours. The success of the osmogene was not so apparent until the time when these regulations were scrupulously followed. The irregularities which nearly discouraged the manufacturers were only caused by the want of washing and cleanliness.

One man and a boy suffice to set a group of apparatus at work. All they have to do is to regulate the flow of the two liquids by aid of the cocks. The syrups which flow into the osmogenes are heated to the boiling point of water. The expense in labour, coal, parchment-paper, animal black, mechanical labour for taking down and setting up the apparatus when it is necessary to change the papers, is 2 fr. per hectolitre, or 1 fr. 40 c. per 100 kilogs. The 100 kilogs., giving at least 25 kilogs. of sugar No. 15, require an expenditure of 5 fr. 58 c. per sack, which is a small amount, when we take into account that the produce is worth from 56 fr. to 57 fr. the sack at market price the 54 sack (the No. 12), a price which is also very ill remunerative to the manufacturer. The latter will have a powerful auxiliary in the osmose to compete with the low prices which ruin the native sugars.

Tar, in a thousand different forms, is the pharmaceutical preparation now mostly in vogue. M. E. Guyot has made a special subject of it, and has reason to be proud of the success of his tar liquors prepared in the following manner:—Concentrated tar from Norway 11 kilos., water 20 litres, carbonate of soda 1 kilo.; the whole is then heated in a distilling apparatus in a sand bath. He then takes the liquor which has not passed over the still, and adds a sufficient quantity of water so as to produce 40 litres of liquid. It is then allowed to settle, and the clear part poured over into a barrel. The volatile portions obtained are then added, and the whole well mixed together for some minutes, and left to stand for several days, and then filtered. The result thus obtained is a dark brown liquor, of a strong aromatic taste, mixing perfectly with water, and giving tar water. Thirty-two grammes (one ounce) contain one grain of resinous matter.

Before concluding, I would also point out M. Adrian's cases, which contain an officinal solution of perchloride of iron and magnesium, neutral and unalterable, adopted by the new French Pharmacopœia, p. 182; a medicinal collodion, very adhesive and very elastic, entered also into the new Codex; an excellent quality of cucumber ointment, of which eight tons are sold annually; a granulated vegetable tar, very easily taken internally, and very efficacious; a fluid for bronzing iron and steel; a resinous powder which enables gold to be applied without difficulty to silk, leather, paper, or to tissues in general.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, April 18.

Dr. J. H. Gladstone, F.R.S., Vice-President, in the Chair.

The minutes of the previous meeting were read and confirmed, and a long list of donations to the Society's library announced, and acknowledged by a vote of thanks. Mr. William Phipson Beale, barrister-at-law, Stone Buildings, Lincoln's Inn, was duly elected a Fellow of the Society, but the result of the ballot was adverse to the election of another candidate proposed at the same time. For the first time were read the names of Mr. Robert R. Tatlock, Millhouse, Kyles of Bute; and Mr. Walter William Fiddes, gas engineer, Southernhaye, Clifton; and for the second time were read the following: Messrs. William Gowland and George Robert Gowland, 48, High Street, Sheffield; Mr. John Cargill Brough, journalist, 4, Norman Terrace, Stockwell; Mr. Edward Packard, jun., manufacturing agricultural chemist, Ipswich; Mr. F. W. Peterson, of Her Majesty's Mint, Calcutta, 51, Myddelton Square, London.

Mr. J. Spiller read a paper entitled "*Observations on the Weathering of Copper Ores.*" The speaker quoted several authorities in support of the assertion that copper pyrites and other sulphide ores of copper undergo a slow oxidation on exposure to air and moisture with formation of blue vitriol, the conditions favouring this change being briefly alluded to. The examples of natural oxidation, to which reference was specially made, were instances of the conjoint action of water and air upon certain Devonshire ores containing mundic, spathic iron, and mica-schist in admixture with the copper pyrites. Their assay gave from 8 to 9 per cent. of metallic copper, and the examination further extended to several waste cupriferous materials, or "tailings," containing between 1 and 3 per cent. of the same metal. The ores proper had the following average composition:—

	In 100 parts.
Cupriferous pyrites . .	36 to 40
Spathic iron	10 ,, 14
Sand, mica-schist, &c. . .	54 ,, 46

The "tailings" proved to contain, besides sand and schist,

Cupriferous pyrites . .	3·7 to 12·1 per cent.
Spathic iron . . .	12·0 ,, 23·9 ,,

By the action of hydrochloric acid the two last-named minerals were separated, and the spathic ore was found to contain, as usual, much carbonate of lime, and nearly 10 per cent. of the carbonate of manganese.

The watercourse in which the washing and commercial preparation of the above-mentioned ores was conducted showed no trace of sulphates, and but a very small proportion of mineral constituents—chiefly carbonate of lime—when collected above the mines; but immediately below the workings the dissolved impurities were greatly increased—from 4·5 to 15·3 grains per gallon—and there was besides much pulverulent copper ore held in suspension. The quality and amount of the contaminating ingredients varied at different times, but chloride of barium never failed to produce with the water an immediate precipitate, and the sulphates of copper, iron, manganese, alumina, and lime were detected. The cupric salt rose on one

occasion to 1·25 grains per gallon, and the sulphate of manganese amounted to 1·38 grains; whilst from a depositing pit close to the mines "green vitriol" was found in solution to the extent of 55 grains per gallon. The sandy deposits from the bed of the river likewise contained metalliferous substances having their origin in the mines, and which were distinctly visible as shining yellow or iridescent particles by the aid of a microscope. Copper ore was detected to the amount of 18 grains in the pound (avoirdupois) of dried sand at a distance of about one mile from the works, and the proportion rose to 97 grains of copper pyrites per lb., midway between this point and the mines.

From a consideration of the nature of the metallic salts introduced into the stream, Mr. Spiller was led to examine more closely the products of oxidation furnished by samples of the moist ore after they had remained in his possession for upwards of a year, and during that interval been subject to the influence of the air, by being preserved in bottles covered with a double fold of paper, which permitted of the evaporation of moisture from the contents. A specimen of ore which at the date of collection gave up to water no appreciable amount of soluble sulphates, and certainly no trace of copper, when examined a year afterwards was found to yield a mixture of sulphates in the proportion of 40 grains per lb. of ore.

In these metallic salts the presence of copper was apparent by its blue colour and other characteristic reactions; and there was much sulphate of manganese, besides a small quantity of protosulphate of iron. A sample of the refuse mud, collected from the stream near the mines in January of last year, and freely exposed to the air during an interval of fourteen months, furnished as much as 64 grains per lb. of a mixture of metallic sulphates upon washing with water. The greatest part of this consisted of sulphate of manganese, with the corresponding salts of copper, iron, and alumina, and a trace of sulphate of lime—ingredients identical with those detected in the water after it had passed the mines and been contaminated by the operation of washing the ores.

The author said that Mr. Church had been associated with him in conducting some of the experiments of recent date. That gentleman had also studied the influence of various metallic salts upon the growth of meadow grasses and other forms of vegetable life. Mr. Spiller exhibited samples of the ores and natural products treated of in the paper, and concluded his account with the following general remarks:—

From these experimental observations, it follows that not only is blue vitriol a product of the action of air and moisture upon crude samples of copper pyrites ore, but that secondary reactions usually occur in consequence of the presence of spathic iron, aluminous schist, and other associated minerals, the metallic bases of which become converted into sulphates at the expense of an oxidised portion of the sulphur contained in the ore. It will be necessary to adopt some precautions (the use of chalk or lime, for instance) to avert the baneful influence of such metallic salts upon land irrigated by, or naturally subject to, the overflow from streams thus impregnated with mineral poisons. And finally, these experiments disclose the existence of vast quantities of waste cupriferous material which it would be very desirable to utilise.

The Chairman moved a vote of thanks to Mr. Spiller for his communication, and said that the facts stated had, he believed, an interest for several Fellows whom he saw in the room.

Mr. David Forbes said he could corroborate Mr. Spiller's experiences from the results of his own observation. Some copper ores underwent a very rapid oxidation on exposure to air. There was, for instance, a Spanish pyrites ore from which the copper could be extracted by merely being laid upon an inclined plane, watering occasionally, and treating the washings from it with scrap iron to effect the reduction of the sulphate formed. It was curious to notice the modified action under some circumstances in the mine itself, particularly in the formation of metallic copper, which sometimes appeared as pseudomorphs with the hexagonal form of arragonite. The speaker had satisfied himself of the reality of the occurrence of these natural changes by being enabled to repeat them in the laboratory. The presence of so much as 2·9 per cent. of copper in a sample marked "tailings" was unusual, and must be taken as evidence of careless working, since most Cornish copper ores submitted to washing contained originally less than this amount of metal.

Mr. F. Field had watched the oxidation of copper pyrites ore in Chili, and had noticed not only the formation of considerable amounts of the sulphate, but, under the peculiar circumstances of a seashore locality, also large quantities of the oxychloride of copper, artificial "atacamite." In a horizontal flue, or culvert, the sandy floor of which was impregnated with sea salt, he found, in 1858, no less than 27 cwts. of cupriferous material—the result of a single year's accumulation—and of this a large proportion was a mixture of brochantite and atacamite.

Professor A. H. Church wished to add a few words to the statement made by Mr. Spiller. The speaker had made special experiments with the copper ores in question, by placing them in the state of fine powder upon grass and other herbage, and keeping them properly moistened with water of undoubted purity, and yellow spots were formed upon the blades of grass wherever the particles of copper pyrites rested, and eventually the whole plot was blighted and killed. The effect of sulphate of manganese was found to be very prejudicial to vegetation, and the sulphate of iron was known to be so. After describing the physical features of the locality, and the manner in which the meadows were irrigated, Mr. Church stated that he had independently traced the copper ore in the stream at great distances below the mines; he had likewise satisfied himself regarding the existence of cobalt; but of manganese there was so large an amount that its presence could be clearly demonstrated, in a fluid drachm of the mine water, by evaporation to dryness and fusion of the residue with caustic soda and a little chlorate of potash. Mr. Spiller and himself had particularly noticed the luxuriant growth of water-weeds in the pure stream above the mines, whilst at the workings and everywhere below their existence was abruptly terminated, and all the fish had disappeared.

Mr. Spiller was glad to find that his short paper had elicited so ample and interesting a discussion. In reply to Mr. Forbes he would simply remark that the richest of the three samples of "tailings," of which analyses had been given, formed portion of a considerable deposit which might eventually be submitted to a more careful dressing, and then worked as an ore.

A short paper entitled "*Oxidation of the Acids of the Lactic Series*," and a preliminary note "*On Limited Oxidation with Alkaline Permanganate*," by Messrs. E. T. Chapman and Miles H. Smith, were read by the first-named author; and the Secretary also read a paper from Dr. F. Crace Calvert, "*On the Presence of Soluble Phosphates in Cotton Fibre, Seeds, &c.*"

[Pressure of more important matter compels us to defer a report of these communications until next week.]

The meeting was then adjourned until Thursday, May 2.

ACADEMY OF SCIENCES.

(From our own Correspondent.)

April 15, 1867.

MM. Coulvier-Gravier and Chapelas resumed in a note their observations of twenty years (1845-1856) on the displacement in the night and morning, and from the east to the west, of the resultant of the falling stars, and have laid

down the following laws, to which we call the attention of M. Schiaparelli:—1st. The displacement of the resultant is greater in proportion to the size of the meteorites. 2nd. The displacement is not the same at different epochs: it is greatest from January 1 to May 1; the minimum is between May 1 and September 1; its average amount is on September 1, October 31. 3rd. In January, March, and May, the resultants approach nearest to the south and south-west, and which constitute bad weather; from June to October the resultants meet towards the east, this being the period of fine weather; lastly, in October, November, and December, the resultants redescend to the south and south-west. 4th. The resultants of the red stars and globular stars occur between the south and the west, which idea leads to the considering of them as forerunners of winds and tempests, which always come from that direction.

M. Delosse presented a coast map of France.

M. Fizeau returned to the subject of the abnormal contractions and dilatations of iodide of silver. He finds in the case of this salt, whether in its amorphous or crystalline state, that the action of heat established by him is reversed; its dilatation is negative, contracting instead of expanding on the increase of temperature. But this negative dilatation is not quite the same in the amorphous state, in the state of compressed precipitate, as in the crystalline state; −0·00000137 in the first case, −0·00000139 in the second.

The Reverend Father Secchi, of the Roman College, gave an account of his stellar spectroscope and the different spectra of several classes of stars. He explains by the differences of temperature, or by the effect of absorption, the variation in intensity of certain lines—the line F, for example, one of those of hydrogen, which are determined by the comparison of the stellar spectra.

Father Secchi presented also the drawings and figures of his meteorograph, an admirable instrument which registers automatically the temperature, barometric pressure, the amount of water in the atmosphere, the force of the wind, &c.; it is one of the marvels of the Paris Exhibition. The reverend *savant*, lastly, communicated an observation tending to prove that iron heated to a white heat is transparent.

April 22.

Messrs. J. Tyndall, Charles Brooke, and Hirst, of the Royal Society of London, were present at this meeting.

M. Sanson maintained, against the opinion of M. d'Arrest, that a teratological accident could not produce a new race, and persisted in denying the existence, in South America, of a flat-nosed bovine race, called natá or niata, and which has disappeared.

M. Lecoq, of Clermont-Ferrand, corresponding member, communicated a curious observation upon the intense vibratory motion in the heart of an oloclasia, a very remarkable alimentary plant, from its great round naked roots. The vibrations, from 110 to 120 per second, are communicated to the box, and a little bell attached to the plant is set ringing. M. Lecoq asks whether this is not a transformation of heat into mechanical motion.

M. Tresca read a second part of his researches on the flowing of solids through simple or multiple, circular, polygonal, and lateral orifices, and described a great number of interesting particularities which confirm the results of his former experiments, and undoubtedly prove that the molecules of substances of the stiffest nature in appearance possess the property of moving independently generally in parallel directions. The flowing takes place in concentric zones or calottes more or less elongated, which sometimes are folded together, &c.

M. A. Milne-Edwards read the *résumé* of a memoir of a new family of "*Rongeurs*," called by him *Sophromys Imhausii*, brought from Aden by M. Imhaus. This little animal has lived for two years in the Garden of Acclimatation. It differs much from other known species—by the prolongation of the hind legs, which are terminated by veritable hands; by the numerous granulations, regular and symmetrical, on top of the head; by the lateral prolongation in an arched form of the sinciput, which descends on both sides as far as the cheek bones, and other differences.

Mr. Sterry-Hunt, of Quebec, Canada, the celebrated geologist, recently elected a Fellow of the Royal Society of London, read a paper on the formation of gypsums and dolomites. Already, in 1859, he had shown—1. That the mutual reaction of bicarbonate of lime and sulphate of magnesia gave rise to sulphate of lime and bicarbonate of magnesia. 2. That all the carbonates of magnesia arose from the decomposition of the primitive silicates, aided by atmospheric carbonic acid. 3. That a double anhydrous carbonate of lime and magnesia, having the composition of dolomite, can be produced by heating slowly, from 120° to 150° C., a mixture of lime and hydrated carbonate of magnesia. 4. That there are dolomites which contain greater or less proportions of magnesia, whether in the stale of hydrated carbonate of magnesia or in the state of simple hydrate. It is evident, then, that the loss of carbonic acid of the solutions of gypsum and bicarbonate of magnesia explains the partial decomposition of the former.

NOTICES OF BOOKS.

Familiar Lectures on Scientific Subjects. By Sir John F. W. Herschel, Bart., K.H., &c. London: Alexander Strahan, 56, Ludgate Hill. 1867.

The reading public hold very generally in high estimation such authors as Faraday, Hugh Miller, Prof. Forbes, and Sir John Herschel, who, bearing names second to none in their respective branches of scientific knowledge, occasionally left all technical language behind them, and familiarly introduced to the person of ordinary intelligence the latest triumphs of all-conquering science.

The benefits accruing to science from such familiar lectures, as long as they are not too familiar (for science has a dignity to maintain), are very great; by their means the sphere of scientific interest is enlarged, and listeners are not unfrequently converted by them from simple admirers to energetic workers in a boundless field. These are not the only reasons that might be urged with advantage to the people who continually are talking about a little knowledge and its dangers. Familiar lecturers on scientific subjects contain in their roll the noblest names of the day, whether they appear at St. Martin's or St. James's Hall, or at working men's lectures at the School of Mines.

In this roll of heroes there is no more worthy knight than Sir John Herschel, and we hope that the essays in the volume before us will be placed side by side with the "Chemistry of a Candle" for generations yet to come. We say essays, for each of the fourteen lectures is perfect in itself, and most varied subjects are treated in the most diversified manner—*e.g.*, "Hermogenes and Hermione discussing Atoms" (Lecture XI.), and Lecture X., a critical essay "On the Yard, the Pendulum, and the Metre." The preface gives us full details of the causes of this dissimilarity of matter and treatment. The first three essays, "On Earthquakes and Volcanoes," "The Sun," and "Comets," appeared in *Good Words*, being founded on lectures given to a village audience in a schoolhouse. "Weather and Weather Prophets," "Celestial Measurings and Weighings," "Light" (Essays IV. to IX.), from the same source. Lecture IX. "On Sensorial Vision," was delivered at the Leeds Literary and Philosophical Society, in 1858; Lecture X., "On the Yard, Pendulum, and Metre," to the Astronomical Society of the same town, 1863; and the author remarks with the true spirit of a watchful foe, in referring to legislation on the subject, "The agitation in favour of which only sleeps for the

present, in the view of allowing the public mind to familiarise itself with the idea under a permissive act—to be assuredly brought forward again with renewed activity, and under a more intense and prolonged pressure (to be met by a more concentrated and determined resistance) on no distant occasion." We never did Sir John Herschel the injustice of imagining that he was not thoroughly earnest in the matter. The dialogue on atoms, so widely known to all readers, appeared some time ago in the *Fortnightly Review* for the first time, and was followed by the essay on the origin of force.

The last essay, on target-shooting, is fresh, we believe; it certainly is not a familiar lecture, and a familiar lecture-reader, if he began the book at the end, would certainly never reach the beginning. The paper immediately preceding it, treating "of the absorption of light by coloured media, viewed in connexion with the undulatory theory," is already in part familiar to our readers, it being the substance of a paper read before the Section of Physics of the British Association, at Cambridge, 1853, none of the heat vibration views of later date being discussed. This is, we suppose, another "familiar lecture," but we will not quarrel with the title of the book, the mass of matter being indeed familiar, especially at the outset; but as we go on we progressively pass from *Good Words* to the *Fortnightly*, thence to local scientific societies, afterwards a step further to the Physics Section, British Association, till the climax of erudition is attained at the end of the book by the estimation of skill in target-shooting. It requires a good physical and chemical scholar to do justice to this work, as a whole, such is the author's versatility, and so great are his powers of putting a thing that seemed most abstruse in the clearest light. We shall take further opportunities of noting the details of some of the papers of greater interest; at present we will notice only the book generally. It forms a handsome volume, and is very neatly printed, being the kind of work that schoolmasters so like to come across for class prizes, for which purpose we can recommend no book more strongly.

A debt is owed to Sir John Herschel by every philosopher, who has to the present time always been subject to some awful quotation or other from Swift as a final answer to anything advanced as being a scientific truth; and as the adventures in Lilliput, Laputa, and Brobdingnag are quite outdone by the discoveries of modern science, a little scepticism is allowable. But Swift has never before been so thoroughly answered, as far as his attack on the Royal Society is concerned, as now, p. 62—"After all, Swift's idea of extracting sunbeams out of cucumbers, which he attributes to his Laputan philosophers, may not be so very absurd;" for it is the actual identical heat which the sun puts into the coal while in form of living vegetation, that comes out again when it is burnt *as* coal in our grates and furnaces.

Swift's idea may seem strange to us. "Not more so, at least, than some of his other Laputan speculations, such as calcining ice into gunpowder, or moving vast locomotive masses by magnetism; both which feats have, in a somewhat altered form of expression, been accomplished (as in the explosion of potassium when laid upon ice, and the movement of a ship by electro-magnetism); or than his plan for writing books by the concourse of accidental letters and selection of such combinations as form syllables, words, sentences, &c., which has a close parallel in the learned theories of the existing races of animals by natural selection."

The style of the essays at once shows the authorship; and the profundity of the scientific remarks made—or, rather, the philosophical light by which all things are illumined, to be found on every page—becomes at times quite amusing. With quotations to illustrate this, we conclude our notice, strongly recommending the reader to add to them for himself.

On p. 19 we read, "The earthquake rolls away, and industry, that balm which Nature knows how to shed over every wound, effaces its traces and festoons its ruins with flowers. It seems, no doubt, terrible, awful, perhaps harsh, that 20,000 or 30,000 lives should be swept away in a moment by a sudden and unforeseen calamity; but we must remember that sooner or later every one of those lives must be called for, and it is by no means the most sudden end that is the most afflictive." Such thoughts must be a great consolation to the inhabitant of a volcanic district, and are certainly quite satisfactory to such as do not live in the neighbourhood. Herod might so have reasoned with the mothers of the slaughtered innocents. A typical case is given, p. 42, at Terra Nova—"Altogether about 40,000 people perished by the earthquakes, and *some* 20,000 more of the epidemic diseases produced *by want* and the effluvia of the dead bodies."

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt. October-December, 1866.

K. von Hauer "*On the Solubility of Isomorphous Salts and Mixtures of the same;*" "*On a Pseudomorph of Chlorite after Granite;*" "*Analysis of Tertiary Coals.*"—H. Höfer: "*Analysis of some Magnesia Rocks from Obersteiermark.*"—A. Pichler: "*Contributions to the Geognosy of the Tyrol.*"—A. Fellner: "*Analysis of some Dibasic Rocks from Borek Dobrowka, Bohemia.*"—A. Gesell: "*Analysis of Spathic Iron Ore from Altenberg, near Neuberg.*"

Photographisches Archiv. January 19, 1867.

A. Poitevin: "*Photographs on Paper in Natural Colours.*"—O. Baratti "*On 'Photoplastic.'*"—W. Crookes "*On the Removal of Organic Impurities from Water by Permanganate of Silver.*"—C. A. Joy "*On Carbolic Acid as a Developer;*" "*On J. Schnauss' Succinic Acid Developer.*"—"*On the Formation of a Photographic Society in San Francisco.*"

Le Génie Industriel. February, 1867.

F. Laumonier: "*An improved Coke Oven.*"—R. H. Ashton "*On a Method of Producing Pictures similar to Woodbury's Photo-Relief Prints.*"—Chapiseau: "*A Method of Manufacturing Artificial Pearls.*"—Bigeard: "*A new Method of Glazing Roofs.*"—Chatin: "*A new Thermometer for ascertaining the Temperature of Hay Ricks, &c.*"—Guenier and Plichon "*On a Method of Covering Articles of Grey Cast Iron with a layer of White Cast Iron.*"—Boutron and Boudet "*On 'Hydrotimetry,' a Process for ascertaining the Purity of Water.*"

March, 1867.—A. Delamare: "*A Method of Dyeing and Printing Threads.*"—"*An improved Man-Engine in use at the Himmel-fahrt Mine, near Freiberg.*"—J. C. Friedleben "*On the 'Gazograph,' an Automatic Apparatus for Registering and Controlling the Quality of Gas.*" R. Houdin "*On some new Instruments for Examining different parts of the Eye.*"—C. Stammer "*On the Extraction of Sugar from Molasses by means of Sugar-Strontia, and Lime.*"—Evrard: "*An Improvement in the Use of Lime in the Manufacture of Sugar.*"

Annales du Génie Civil. March, 1867.

"*On the Calorific Value of French Coals.*"—J. Nickles "*On the Concentration of Saline Solutions.*"—E. Soulié: "*Note on the Attempts which have been made to use Petroleum as a Steam Fuel.*"—Limet "*On a Specimen of Boiler Scale, and on some Methods of Preventing its Formation.*"—Flachat: "*Remarks on the above Paper.*"—Farcot:

"*Remarks on the above Paper.*"—Ribail: "*Remarks on the above Paper.*"—H. Tresca: "*Remarks on the above Paper.*"—De Mondesir "*On Wiessnegg's Gas Blowpipe.*"—"*An Account of the Paris Exhibition Building, and of the Works in connexion therewith.*"—Evrard "*On the Manufacture of Aluminium Bronze.*"—Brisse: "*A new method of Manufacturing Soda.*"—Bertrand: "*A new method of Extracting Vegetable Oils.*"

Comptes Rendus. March 4, 1867.

A. W. Hoffmann "*On the Transformation of the Aromatic Monamines into Acids, containing a greater Proportion of Carbon.*"—G. Kirchoff "*On Sun Spots.*"—Faye: "*Remarks on the previous Paper and on the Theory of Solar Clouds.*"—Berthelot "*On the Changes of Temperature which take place in the Mixture of certain Liquids;*" "*On some general Conditions which govern Chemical Reactions.*"—L. Clemandot "*On Glass.*"—De Laire, C. Girard, and Chapoteaut: "*Some Facts relating to Colouring Matters obtained from Coal Tar.*"—E. Reboul "*On the Polymers of Valerylene.*"—A. Eulenberg "*On the Action of Sulphate of Quinine on the Nervous System.*"

March 11.—Baille "*On the Construction of Lenses for Telescopes and other Optical Instruments.*"—E. Mascart: "*Memoir on the same subject;*" "*On the Determination of the Lengths of the Waves of Light.*"—A. Voisin and H. Liouville: "*Researches on Curara.*"—Cahours "*On the Compounds of Antimony, Tin, &c., with the Hydrocarbons of the Marsh Gas Series;*" "*On Vapour Densities.*"—Lailler "*On the Extraction of Opium from the Poppy.*"—Debeaux "*On Chinese Pharmacy.*"

March 18.—Dumas "*On a Specimen of Anthracite remarkable for its Hardness.*"—H. A. Faye "*On the general Character of the Appearances of Shooting Stars.*"—U. J. Leverrier "*On the Eclipse of the Sun of March 9, 1866.*"—J. Dubosco "*On A. Chevalier's Self-acting 'Photographometer.'*"—W. Schiaparelli "*On the Shooting Stars of August and November, and on the Identification of their Orbits with those of the Comets of 1862 and 1866.*"—L. Daniel "*On the Transport of Matter by the Voltaic Current and by Induction Currents.*"—H. Debray "*Researches on the Dissociation of Solids.*"—D. Gernez "*On the Influence of a Current of Gas on the Decomposition of Bodies.*"—P. Hautefeuille "*On the Action of Heat on Hydriotic Acid.*"—J. Reonault: "*Researches on Thallium Amalgam.*"—A. Scheurer-Kestner: "*New Researches on the Theory of Leblanc's Process of Manufacturing Soda.*"—Le Guen "*On the Manufacture of Bessemer Steel containing Tungsten.*"—P. Bert "*On the so-called 'Period of Excitation' which occurs during the Inhalation of Ether or Chloroform.*"

March 25.—Daubrée "*On two large Masses of Meteoric Iron from Caille, Maritime Alps, and Charcas, Mexico.*"—Chevreul: "*Observations on a Treatise on Alchemy attributed to Alfonso X.*"—J. Serra-Carpi "*On the Application of the Pendulum to the Determination of Specific Gravity.*"—J. P. Revollat: "*Note on Magnetism and Electro-magnetism.*"—Henke "*On the Use of Benzol as a Remedy for and Preventive against Cholera.*"—Deleuil "*On an improved Air and Force Pump.*"—Palmieri "*On the Ammoniacal Products found in the Upper Crater of Vesuvius.*"—Mene: "*Note on a Specimen of Anthracite of great Hardness, mentioned by Dumas at a recent meeting of the Academy.*"

The Ruhmkorff Coil.—Congress is about to do justice to an American inventor, Dr. Charles G. Page, of the United States Patent-office, by an act authorising him to apply for and receive a patent for his induction apparatus and electric circuit breaker, known as the "induction coil," the merit of which was awarded by the Emperor of France and a French Commission to Ruhmkorff, without knowledge of Dr. Page's invention.—*American Artisan.*

NOTICES OF PATENTS.

2025. *Producing Gas for Illuminating Purposes.* J. Hamilton, Glasgow. Dated August 6, 1866.

A method by which the heavier carburetted oils serve as a basis for greater illuminating power.

2026. *Improvements in the Manufacture of Carbonates and Bicarbonates of Soda and Potash, the Soluble and Insoluble Silicates of Soda and Potash, and Muriatic Acid, from Chlorides of Sodium and Potassium.* W. E. Newton, Chancery Lane, London.

The process begins by the action of nitric acid on the sodic and potassic chlorides. At a high temperature the nitric acid is replaced by silicic acid, so getting the various silicates, the more of the soluble ones the better; the nitric acid is recovered and used again, and the silicates are in turn decomposed by carbonic acid under strong pressure. By stopping at the various stages, the different products are obtained.

2043. *Production of Sal-Ammoniac in a Commercial Form.* P. Spence, Newton Heath, Lancashire. August 8, 1866.

The salt will by this method be prepared in compressed cakes for economic use.

2066. *Improvement in the Utilisation of Chloride of Manganese (residue of Manufacture of Chlorine) in the Manufacture of Peroxide of Manganese, Chlorine, and Hydrochloric Acid, and in Apparatus for the same.* W. Clark, Chancery Lane, London.

By means of the apparatus used, a manufacturer's compound is regained from a waste product, the recovered manganese peroxide being used, converted into chloride, and again used, *ad infinitum*. No residue of the manganese chloride is left, it is stated.

2067. *Apparatus for Manufacturing Illuminating Gas, and producing Bone Black and other valuable Residuum.* J. T. Ensley, New York, U.S. August 11, 1866.

This abandoned process, which probably would not be commercially successful, is applicable for many purposes, and would answer were the residuum sufficiently valuable. A retort is used with a fire chamber and smoke pipe. A chamber is placed in the retort, opening only outwards, to receive a charge. A cylinder fits this chamber accurately, being open at one end for the charge; any number of these may be provided. When charged the open end of the cylinder is closed by a well-fitting cover, held closely applied to the cylinder by a pressure screw. From this air-tight chamber the gases are carried by a pipe, and are purified by a communicating system of vessels, and so pass to the gasometer.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

Notices to Proceed.

3111. T. J. Barron, New York, U.S.A., "A new and improved method or process for converting iron into steel by the action of certain gases, and for producing gases for such purpose."—November 26, 1866.

3171. J. T. A. Mallett, Boulevart St. Martin, Paris, "A process and apparatus for producing, jointly or separately, oxygen and chlorine from the same chemical substance and in the same apparatus."—December 3, 1866.

3203. T. J. Chubb, Brooklyn, New York, U.S.A., "An improved process and furnace or apparatus for the manufacture of steel, or metals having some of the properties of steel."—December 5, 1866.

3432. G. Payne, Battersea, Surrey, "Improvements in the manufacture of soap."—December 29, 1866.

378. E. Gorges, Neuilly, France, "Improvements in preserving meat, poultry, and game."—February 9, 1867.

CORRESPONDENCE.

Natroborocalcite.

To the Editor of the Chemical News.

Sir,—Referring to a paper on Natroborocalcite in the last number of the Chemical News, by Professor How, I beg leave to remark, in justice to Dr. Kraut, that this gentleman has not overlooked Dr. How's priority in reference to his formula for the above-named mineral. He has, on the contrary, treated the history of the analysis of that mineral so fully that I thought myself excused from expatiating on it again. When calling the formula in question "Kraut's formula," I did not at all mean to contest the undoubted claim of Dr. How to have established it first in some instances, but I referred to Dr. Kraut's having subsequently endeavoured to prove its general validity from many other analyses. He even succeeded, in fact, in eliminating some analyses which seemed at first to contradict How's formula. Nevertheless, this has not been possible in the case of the sample first analysed by me, and then by Dr. Kraut himself, as explained at the close of my paper in the Chemical News of February 22, 1867. I am, &c. G. Lunge, Ph.D.

South Shields, April 20.

Reduction of Weighings to a Vacuum.

To the Editor of the Chemical News.

Sir,—In your paper on the adjustment of chemical weights, published in the last number of the Chemical News, you say, "The value of the weights thus given is their weight in *air* of the ordinary pressure; it therefore becomes necessary to reduce them to what they would be worth in a vacuum;" and in the table you state that the 1000 grain weight weighs, *in vacuo*, 1000·1462 grains. This I quite understand; but on turning to Professor Stas's researches on the atomic weights,* I find, where he has reduced the weights in air to weights *in vacuo*, there is a slight diminution. For instance, in the table given on the page referred to, he says, "weight of the silver in air, 91·4655 grammes; weight of the silver reduced to a vacuum, 91·4620 grammes." How is this to be accounted for? I am, &c.

J. Lloyd Smith.

Dublin, April 23.

[The downward pressure which a body exerts when suspended in a fluid, (air or water), is equal to its absolute weight, *minus* the weight of the fluid which it displaces. This applies to the weights as well as to the body weighed. *In vacuo* masses of matter exert the maximum downward pressure. The equation in air is —Weight of body, *minus* weight of air it displaces = weight of weights, *minus* weight of air they displace. If, therefore, the substance weighed be *lighter* than the weights it is weighed against, the correction for the vacuum will increase the weight of the mass. If, however, the substance weighed be *heavier* than the weights, the correction for the vacuum will require a subtraction to be made from the apparent weight of the mass in air. On turning to the table quoted by our correspondent (Chemical News, iv. 228) it will be seen that the vacuum-weight of the *silver* is slightly less than its air-weight, but the vacuum-weight of the *chloride* of silver is greater than its air weight. The inference from this is that Professor Stas used brass weights, which would be intermediate in specific gravity between silver and chloride of silver.—Ed. C.N.]

* Chemical News, vol. iv. p. 228, &c.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Silicium Compounds, some New (Si = 28, O = 16).—C. Friedel and A. Ladenburg. Wöhler and Buff prepared an inflammable silicic chloride by the action of chlorhydric acid gas on crystallised silicium, but did not obtain it in a state of purity. The authors have repeated the experiment, and have isolated $SiCl_3H$, boiling between 34° and 37°·5, the vapour of which mixed with air explodes on contact with an ignited body. Chlorine converts it into silicic chloride. Bromine does not act on it at the ordinary temperature, but at 100° the mixture becomes colourless. Absolute alcohol which has been digested with ethylic silicate and distilled reacts with it to form

$$\left.\begin{matrix}(SiH)'''\\(C_2H_5)_3\end{matrix}\right\}O_3,$$

boiling between 134° and 137°, bearing to the inflammable chloride the same relation as that existing between ethylic silicate and silicic chloride. It differs from ethylic silicate by greater inflammability, and by the property of disengaging hydrogen when mixed with alcoholic solution of ammonia. If sodium be introduced into it, silicic hydride, SiH_4, 2 volumes, is evolved; the sodium remains bright, and the reaction at present is unintelligible. This gas is not spontaneously inflammable, at least at ordinary temperatures. $SiCl_3H$ in contact with water at 0° seems to form $Si_2H_2O_3$.

We may compare $SiCl_3H$ with CCl_3H chloroform, $SiH(C_2H_5O)_3$ with Williamson's $CH(C_2H_5O)_3$ tribasic ethylic formate, SiH_4 with CH_4 methylic hydride, and $\left.\begin{matrix}SiHO\\SiHO\end{matrix}\right\}O$ with $\left.\begin{matrix}CHO\\CHO\end{matrix}\right\}O$ formic anhydride? These analogies suggest a convenient nomenclature, silicichloroform, tribasic ethylic siliciformate, siliciformic anhydride.—(*Comptes R.* lxiv. 359.)

Benzylic Bromide (C = 12).—C. Lauth and E. Grimaux. Bromtoluol from toluol and bromine (*Bull. Soc. Chim. Paris*, 1866, 347) resists potassic acetate, ammonia, alcoholic solution of potash, and fusing potash. Kekulé's benzylic bromide, from benzylic alcohol and bromhydric acid, differs, according to his views, from bromtoluol, as shown by these formulæ:—

C_6H_4Br,CH_3	C_6H_5,CH_2Br
Bromtoluol.	Benzylic bromide.

By the action of bromine vapour on toluol vapour, benzylic bromide boiling at 202° is obtained, capable of interchanging with potassic acetate to form potassic bromide and benzylic acetate, and, like benzylic chloride, when treated with nitric acid giving benzoylic hydride. No bromtoluol is produced. Beilstein's view, that by operating on hot toluol chlorine or bromine is introduced into the lateral chain, and in the cold into the principal chain of carbon atoms, is thus confirmed. The authors propose, in like manner, to examine xylol (dimethyl-phenyl) and coal-tar cumol (trimethyl-phenyl).—(*Bull. Soc. Chim. Paris*, 1867, 108.)

Oxidising Properties of Benzol Homologues.—M. Berthelot. Toluol, like oil of turpentine, when shaken with indigo solution, decolorises it. Benzol does the same, but very slowly. Cumol, xylol, and styrol are in this respect intermediate between toluol and benzol. Naphthalene has no action.—(*Bull. Soc. Chim. Paris*, 1867, 109.)

Hydrocarbons, Compounds of, with Potassium (C = 6).—M. Berthelot. Coal-tar cumol, and probably cymol, acetylene, naphthalene, anthracene, retene, &c., and phenyl, form compounds with potassium, and, less definitely, with sodium. The properties of all these compounds are nearly identical. To prepare the naphthalene compound, potassium is gently fused under naphthalene, the black crust removed from the surface of the metal as quickly as it forms; the naphthalene remaining after the potassium is entirely converted is dissolved out with

benzol; a black powder ($C_{20}H_8K_2$) remains; no hydrogen is evolved. Water decomposes this compound, with production of a hydrocarbon ($C_{20}H_{10}$?) more fusible than naphthalene. If the naphthalene and potassium be surheated, a red-brown, very sparingly soluble hydrocarbon is produced, the solution of which presents powerful orange fluorescence, recalling Fritzsche's chrysogene. Great analogies exist between these compounds and those resulting from the action of potassium and sodium on chlor- and brom-derivatives of hydrocarbons.—(*Bull. Soc. Chim. Paris*, 1867, 111.)

Silicic Acid, Isomeric States of (Si=44·5).—E. Fremy. Silicic acid is derived from quartz, metasilicic acid from silicic fluoride. Alkalic silicates differ from the corresponding metasilicates in their greater tendency to crystallise; they do not, on heating, become insoluble in water, as do the metasilicates; the hydrate separated from them by acids becomes, on ignition, insoluble in alkaline solutions; that from the metasilicates being, under similar circumstances, easily soluble. Both acids are tribasic, and capable of forming primary, secondary, tertiary, and intermediate salts. Hydrated silicic acid forms, with acids, compounds much more stable than the analogous metasilicic acid compounds. Metasilicates, when treated with excess of alkali, change to silicates. The most easily crystallisable alkalic silicate is $(SiO_3)_2,3NaO,27HO$, described by Fritzsche. The type of tertiary silicates is $SiO_3,3MO$; that of tertiary metasilicates $(SiO_3)_3,3MO$. Fremy concurs with Chevreul, who thinks that when a hydrated acid is changed by heat to an isomer the change is due to an allotropic modification of the anhydride, the disengagement of water being a secondary phenomenon.—(*Comptes R.* lxiv. 243.)

Valerylene, New Derivatives of (C = 12).—Reboul. The compounds herein described confirm the former view that valerylene is capable of giving rise to two series of bodies—a group of unsaturated compounds apt to unite with H_2,Br_2 or HBr, and a group of saturated compounds. The bodies described are the monochlorhydrate $C_5H_8\left\{\begin{matrix}H\\Cl\end{matrix}\right.$, dichlorhydrate $C_5H_8\left\{\begin{matrix}H_2\\Cl_2\end{matrix}\right.$, monoiodhydrate, mono- and di-acetates, mono- and di-hydrates. Although valerylene gives rise to a double series of compounds analogous to those derived by Wurtz from diallyl, yet the latter does not appear to be homologous with the former, for the differences between the boiling points of the hydrocarbons and of their respective derivatives are inconsistent with homology.—(*Comptes R.* lxiv. 284.)

Argentic Iodide, Effect of Heat on.—H. Fizeau. Former experiments proved that potassic, sodic, ammonic, and argentic chlorides, potassic and argentic bromides, potassic, mercuric, plumbic, and cadmic iodides, expand more when heated than even zinc or lead (*Comptes R.* lxii.); but argentic iodide, fused or crystallised, contracts as its temperature rises. The fused iodide contracts very regularly between − 10° and + 70°; with equal regularity it expands on cooling.—(*Comptes R.* lxiv. 314.)

Argentic Iodide, Note on.—H. Ste.-Claire Deville. We are reminded of some singular reactions of iodhydric acid and silver. Silver dissolves with disengagement of hydrogen in iodhydric acid solution with production of IH,IAg crystallisable, a solution of which, in contact with silver leaf and air, deposits crystals of argentic iodide. Argentic chloride is decomposed with great evolution of heat by iodhydric acid solution, chlorhydric acid being evolved. Silver leaf immersed in mercuric iodide vapour combines with iodine, and mercury is liberated. Recent determinations prove that amorphous argentic iodide is more dense than fused iodide, and that fused iodide is more dense than crystallised iodide.—(*Comptes R.* lxiv. 323.)

Atacamite, Artificial.—H. Debray. Tribasic cupric nitrate heated to 200° with concentrated sodic chloride solution, gives atacamite as a green crystalline powder; an ammoniacal solution of cupric sulphate heated to 100° with concentrated sodic chloride, deposits all the copper as atacamite in a pulverulent crystalline form. The presence of alkalic chlorides is indispensable. Basic cupric carbonate, sulphate, or phosphate gave no satisfactory result.—(*Bull. Soc. Chim. Paris*, 1867, 104.)

Nitrotoluol.—A. Kekulé. Researches in progress show that Jaworsky's nitrotoluol is the veritable one, and that the liquid is not isomeric with the crystalline nitrotoluol, but a mixture of this with some other bodies.—(*Bull. Soc. Chim. Paris*, 1867, 105.)

Benzylic Chloride (C=12, O=16).—C. Lauth and E. Grimaux. Cannizzaro proved the identity of chlortoluol with benzylic chloride. To prepare this body, excess of toluol vapour at 110—140° is acted on by chlorine; the production of higher derivatives appears even then unavoidable. Heated for two hours with its weight of nitric acid (1 part acid, 10 parts water), benzylic chloride gives benzoylic hydride; or, to avoid secondary action of aqua regia produced by chlorhydric acid set free in the reaction, plumbic nitrate and carbonic dioxide may be used. Benzylic chloride boiled with fresh plumbic oxide gives benzylic alcohol; heated with its equivalent of potassic phenylate, it gives phenyl-benzyl ether decomposed by a high temperature, crystallisable, melting at about 40°; heated to 115° in sealed tubes with rosaniline or rosanilinic chloride in alcoholic solution, a very fine violet colouring matter insoluble in water is produced. Several treatments with benzylic chloride are necessary. Among the higher chloro derivatives found in the first reaction is chlorobenzol. This explains Beilstein's formerly expressed opinion that chlorobenzol is dichlortoluol, refuted by Naquet by the preparation in the cold of dichlortuol; the relative proportions of these isomers depend probably on the temperature employed.—(*Bull. Soc. Chim. Paris*, 1867, 105.)

MISCELLANEOUS.

New College in Dublin.—The following paragraph, quoted from the *Observer*, will interest some of our readers. It will be observed that there are two chemical chairs, one at 300*l.* and the other at 200*l.* per annum. We are given to understand that they are both filled up:—"The arrangements of the Lords of Council on Education and of the Lords of the Treasury respecting an intended new College of Science in Dublin, provide for the conversion of what has been known as the Museum of Irish Industry into such college. It will have ten professorships, seven of which already exist. The professors of applied mathematics, and mechanism, and of descriptive geometry, machinery, and surveying, will have 400*l.* per annum salary, rising to 500*l.* These are new chairs. The professor of applied chemistry will have 300*l.* per annum, and will have to instruct the royal exhibitioners free of charge. Other professors will teach in such subjects as physics, general chemistry, botany, zoology, geology, mineralogy and mining, and agriculture, at salaries of 200*l.* per annum. The government of the college will be vested in a council of professors and a dean of faculty. The secretary of the present committee of lecturers will be secretary to the Council, at 400*l.* a year; and the curator of the museum will be librarian also, at 300*l.* per annum. There will be nine royal exhibitions of 50*l.* each, tenable for three years, three becoming vacant each year. Sir Robert Kane's office as Director of the Museum of Irish Industry is abolished, and he gets no new office in the College, their lordships regretting that there is no one of them which they could offer to a person of his eminence. The total expenditure upon the Irish College of Science will be about 7000*l.* a year."

Bismuth.—A discovery has recently been made in South Australia of a lode of bismuth, samples of the metal being now to be seen at the Melbourne Exchange, to which place it has been sent from the neighbouring colony. This metal is very valuable if found in quantity, and it is stated that the lode discovered contains abundance of rich stuff, but, being situated about 200 miles in the interior, some serious difficulties in the cost of carriage have been encountered. Trouble was also experienced in getting the metal smelted, but a quantity of it was sent to England in ingots a few days ago, and it is expected the supply will be kept up.—*Melbourne Age.*

Pure Caustic Soda.—We have received from the Magnesium Metal Company, Manchester, a specimen of the fused hydrate of sodium which they advertise as prepared from metallic sodium. It appears to deserve the title "chemically pure." It dissolves in water, leaving no residue. The solution, acidified with nitric acid, gives no turbidity with silver or barium salts; hydrochloric acid produces only a barely perceptible effervescence when added to the alkaline liquid, and on evaporation to dryness, and ignition, the chloride of sodium dissolves in water, leaving no residue whatever. Special tests show the absence of phosphoric acid and alumina.

Priestley Commemoration.—At the commencement of this month the scientific people of Birmingham assembled to do honour to the memory of this great philosopher, in whom they possess a special interest, from the fact of most of his discoveries having been made, and most of his works published, in that town. They acknowledge also the disgrace that their unworthy treatment of him is to the town. Dr. Priestley was appointed to the pastorship of the New Meeting at Birmingham, with the stipulation that his week should be allowed for scientific research, ministerial duties being reserved for Sundays only. The chairman, on this occasion, remarked that the worthy doctor's personal habits were peculiar, for he "rose at 6 o'clock in the morning, breakfasted at 8, dined at 1, took tea in the evening, and afterwards enjoyed himself amongst one of the happiest families," &c.—truly a most eccentric character he must have been! With such interesting details a memoir so called was filled up. A just tribute was paid to the Lunar Club, to which Priestley, Watt, Boulton, Galton, Darwin, and Baskerville belonged—a worthy association of great names. It would be well if such clubs existed now in the various large cities of Great Britain, independently of societies and associations. At the conclusion of the proceedings it was resolved "That it was desirable that there should be a public memorial (to be called the Priestley Memorial), and that the council be respectfully requested to consider the best means of securing the same." May this not prove an early April resolution! We learn, too, that there was also an interesting collection of Priestley's relics exhibited. The laboratory of Priestley still exists in Birmingham: the restoration and preservation of this would be a very graceful and fitting memorial.

Meetings for the Week.

Tuesday, April 30.

Royal Institution, 3 p.m. Professor Blackie "*On Plato.*"

Wednesday, May 1.

Royal Institution, 2 p.m. Annual meeting.

Thursday, May 2.

Royal Institution, 3 p.m. Professor Huxley "*On Ethnology.*"

Friday, May 3.

Royal Institution, 8 p.m. Professor Blackie "*On the Music of Speech in the Greek and Latin Languages.*"

Saturday, May 4.

Royal Institution, 3 p.m. Professor Huxley "*On Ethnology.*"

A SUGGESTION TO MANUFACTURERS AND INVENTORS.

Those who read advertisements must often be struck by observing that, while one person advertises for something of which he stands urgently in need, another advertiser often offers for sale, in the same column, precisely what advertiser No. 1 *is trying to obtain. In a similar way it is continually found that a manufacturer is in want of a process that some chemist wishes to dispose of. It also often happens that a difficulty is found in carrying out some manufacture which could easily be overcome by a short investigation by a competent chemist, and, indeed, in many cases a difficulty which appears insuperable to the manufacturer would prove a mere bagatelle to the chemist.*

Impressed with this idea, we wish to call the attention of manufacturers and others to the ease with which they may place themselves in communication with scientific men by the simple means of forwarding their wants to us under the form of "Notes and Queries."

We propose, therefore, if supported by our readers, to insert without charge, but of course briefly, and in the form of queries, the essential points of any letters of inquiry which may be sent to us.

In many cases it is evident that the answers may be published for the benefit of the public generally; in other instances the querist may be placed in communication with the chemist or inventor who has the required information to impart.

The plan thus briefly indicated may also be made to include announcements by inventors of processes or discoveries they may wish to dispose of.

It is, of course, to be distinctly understood that the Editor of this journal does not in any way vouch for the correctness of the information given, nor for the good faith of his correspondents.

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

An Ignorant Student.—*L. Mond.*—In our next.

A Subscriber.—Magnesian limestone or dolomite occurs in beds of considerable thickness and great extent in the north of England. It is also met with in the Isle of Man and in Fifeshire.

S. G. Melbourne—The little modifications and improvements you refer to have been in contemplation for some time, and will in all probability be commenced with our next volume. A series of articles on the other subject of inquiry are now in preparation by the first English authority, and will shortly appear in the Chemical News.

Standard Thermometers.—We have received several communications on this subject, but in its present form we think the discussion has proceeded far enough. The subject, however, is one of considerable importance to chemists, and it is far from our desire to close our pages to it. If any manufacturer or experimentalist will communicate the results of experiments, we shall be glad to give them publicity; but a statement of opinions insufficiently supported by facts has ceased to possess interest.

A Dyer.—No satisfactory results have been obtained in depositing gold from its solutions upon fibrous matters. One of the most promising methods consists in saturating the fibre with solution of chloride of gold, and then exposing it to phosphuretted hydrogen gas, by which the metallic lustre is developed. The result is, however, too irregular to be of use.

J. Y. S. has lined a cistern with hydraulic lime cement, and fancies that the water has been rendered considerably "harder" by its action on the cement; he wishes to know of a remedy. We would suggest that the whole of the inside of the cistern be washed over with a solution of silicate of soda, and allowed to dry thoroughly before the water is put in. Carbonate of soda and the excess of silicate will impregnate the water at first, but this will last for a few days only.

Communications have been received from D. Wilkinson, J. B. Dancer, S. Mellor, W. Bywater, Subscriber (Perth), W. F. Barrett (two communications), J. Browning, J. F. Shaw; Belding, Keith, and Co.; D. Waldie, Sydney Gibbons, Dr. Adriani, Rev. B. W. Gibsone, J. Sylvester (with enclosure), J. Robinson, Dr. Lunge, W. B. Giles, J. Hargreaves, M. J. Stark (with enclosure), Robertson and Scott (with enclosure), J. Jeffery, W. H. Leigh.

Books Received.—Ophthalmic Review; Journal of Materia Medica; Moniteur Scientifique; Photographs of Eminent Medical Men, No. 2, vol. ii.; La Manifattura Ginori a Doccia.

ENGLISH DISCOVERERS AND FRENCH ACADEMICIANS.

A communication on the estimation of copper, from M. de la Follye, was recently brought before the French Academy by M. Pelouze. The author says that, in attempting to estimate copper by Pelouze's process (precipitation by a standard solution of sulphide of sodium), he met with certain difficulties which led him to try another process, and he ultimately decided upon adding a standard solution of cyanide of potassium to an ammoniacal solution of the copper which was to be determined. M. de la Follye calls this "only a modification of the excellent method of that eminent chemist," Pelouze; and as that eminent chemist himself presented the paper, we may assume that he admitted the substantial accuracy of the statement.

We are so accustomed to see English discoveries rediscovered by French chemists and brought before the Academy of Sciences as undoubted novelties, that in general we refrain from drawing attention to this unfairness. It appears to be one of the stages through which an English discovery must pass before it obtains Continental recognition; but for several reasons we cannot allow this instance to pass over without animadversion. Every chemist will at once perceive that the new process of M. de la Follye is absolutely identical with that of Henry Parkes, published in the *Mining Journal* in 1851. Owing to its neatness, convenience, and general accuracy, it has become almost universally employed in the commercial analysis of copper ores, and we venture to say that there is scarcely a laboratory in Europe in which Parkes's process has not been more or less used. In all standard works on analysis, English and German, Parkes's process stands side by side with Pelouze's process; and were it not that an English writer generally remarkable for his literary accuracy has appeared to acquiesce in M. de la Follye's pretensions, we should say that it was utterly inconceivable how any chemist could venture to publish so old and well-known a process as original.

We are glad to see that this discreditable attempt at appropriating Henry Parkes's well-earned laurels has met with an indignant protest from E. F. Dürre, of Berlin, in the *Berg. und Hüttenmännische Zeitung* for March 22. He says that there is "nothing rare in their Western neighbours ignoring foreign merit altogether; but in such a case as this, when a well-known process is brought, as a new discovery, before an important learned Society, by a man of wide-spread reputation and acknowledged ability, it becomes the duty of every one not to content himself with the mere rectification of the error, but to enter a loud protest against such a claim."

After pointing out the utter groundlessness of MM. de la Follye's and Pelouze's pretensions, Herr Dürre concludes by saying that it is necessary that this circumstance be rightly appreciated, to show how cautious one must be in respect to a French communication, even when it is brought before the Academy of Sciences by one of its members.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Determination of Soda in the Assay of Potashes, by M. Graeger.

Commercial potashes generally contain soda. To determine the proportion by volumetric assay, we must know the quantity of pure alkaline carbonates contained in the substance to be assayed. For this object the author dissolves 6·911 grammes of the potash to be assayed in 100 c.c. of water, weighs the insoluble portion, and determines in one part of the solution the quantity of chlorine (chloride of potassium), in another the quantity of sulphuric acid (sulphate of potash), determinations which may be made with standard solutions. The estimation of the alkalies is effected on 10 c.c. of the solution by means of normal nitric acid; and from the quantity of acid added the relation of soda to potash may be calculated, as the total quantity of alkaline carbonates is known by subtracting from the total weight of substance taken the weight of the insoluble matter of the chloride and sulphate of potash.

To assist in the employment of this method, the author has drawn up a table giving the amounts of carbonate of potash and carbonate of soda corresponding to the quantity of normal nitric acid necessary for their saturation:—

KO,CO_2. Grammes.		NaO,CO_2. Grammes.		NO_5. C.C.
1·00	+	0.00	require	14·47
0·95	+	0·05	,,	14·69
0·90	+	0·10	,,	14·92
0·85	+	0·15	,,	15·14
0·80	+	0·20	,,	15·35
0·75	+	0·25	,,	15·57
0·70	+	0·30	,,	15·79
0·65	+	0·35	,,	16·01
0·60	+	0·40	,,	16·23
0·55	+	0·45	,,	16·45
0·50	+	0·50	,,	16·67
0·45	+	0·55	,,	16·89
0·40	+	0·60	,,	17·11
0·35	+	0·65	,,	17·33
0·30	+	0·70	,,	17·55
0·25	+	0·75	,,	17·76
0·20	+	0·80	,,	17·97
0·15	+	0·85	,,	18·19
0·10	+	0·90	,,	18·40
0·05	+	0·95	,,	18·62
0·00	+	1·00	,,	18·84

If, for example, it is found that the crude potash taken contained 5·1134 grammes of pure alkaline carbonate, and it required 79 c.c. of normal nitric acid, the proportion 5·1134 : 1·0 : : 79 c.c. : x will give the quantity of normal acid ($x = 15{\cdot}45$ c.c.) which one gramme would have required, and on reference to the above table it is found that 15·45 c.c. of normal acid correspond to 0·22 of carbonate of soda and 0·78 of carbonate of potash, or 78 per cent. — *Journal für praktische Chemie*, t. xcvii. p. 496 (1866), No. 8.

On the Preparation of Pure Chloride of Ammonium, by J. S. Stas.

(*Continued from page* 194.)

III. Chloride of Ammonium obtained by means of the Ammonia produced by the Reduction of Nitrite of Potassium.—To procure nitrite of potassium, I had recourse to Stromeyer's process. I heated to redness one kilogramme of nitre with four kilogrammes of lead in a small cast-iron crucible. When the vivid incandescence which at first ensued was over, and the mixture sufficiently cooled, I washed it in boiling water. I then, by means of a solution of hydrosulphate of potassium, eliminated the lead from the solution of nitrite. After removing the sulphide of lead and concentrating the remaining solution, I added fifteen litres of a solution of caustic potash of a specific gravity

of 1·250. This mixture was poured into a globe of a capacity of twenty-five litres, placed in a sand-bath, and which contained a mixture of three kilogrammes and a half of granulated zinc, deprived of its carbon by fusion with a mixture of carbonate of soda and nitre* and a kilogramme and a half of iron, which, after having been oxidised by calcination in contact with air, had been reduced by hydrogen.

The globe communicated, through a large bent tube, with an arrangement for washing and condensing the ammonia to be produced. This arrangement consisted of—1st, a large tubulated retort placed upon a furnace and containing a certain quantity of pure water, into which the tube coming from the globe was plunged; 2nd, a large Woulff's flask with three tubes containing half a litre of pure water; 3rd, a Woulff's flask containing water acidulated with hydrochloric acid, for the purpose of retaining the ammonia carried over by the current of hydrogen, which is produced very freely when the reduction of the nitrite takes place and the liquid in the globe is boiled.

Before distilling the liquid in the globe, I allowed the materials to react during seventy-two hours, so as to reduce as completely as possible the nitrite of potassium into ammonia and oxide of potassium and zinc. After this I boiled the liquid gently for two hours, keeping the water boiling in the retort and cooling that contained in the large Woulff's flask intended for the condensation of the ammonia.

It is indispensable to boil the liquid contained in the globe *very gently*, as it bubbles up violently by the disengagement of the hydrogen at a high temperature. I recommend chemists who wish to procure absolutely pure ammonia by this means to distil the liquid decanted from the mixture of zinc and iron. As I ascertained in a subsequent trial, after the reduction of the nitrite into ammonia has taken place, the decanted liquid may be distilled without the least difficulty.

The ammoniacal solution produced smells exactly similar to the ammonia extracted from chloride of ammonium treated with aqua regia, or from sulphate of ammonium treated while hot with a mixture of sulphuric and nitric acids.

These three ammonias, though identical with each other, differed very considerably as to smell from the pure ammonia obtained from commercial chloride or sulphate of ammonium, both of which contain compound ammonias, that give it a disagreeable smell, whilst the smell of pure ammonia is simply pungent. I have already mentioned these facts in my previous work on the same subject.

To transform the dissolved ammonia into chloride, I passed through the solution a current of pure hydrochloric acid until the liquid was nearly saturated. I then evaporated the saline liquid on a water-bath, and finished drying it on a stove. This chloride of ammonium was of a dazzling whiteness. I proceeded to *sublime it in a large platinum retort* purified at a red heat with chloride of ammonium. To exclude the air from the retort, I passed through it, during the volatilisation, a very slight current of dry ammonia. This precaution is absolutely indispensable, since, in the presence of air and of heated platinum, the vapour of sal ammoniac will readily produce nitric acid and afterwards chlorine.

The volatilised chloride of ammonium covered the upper portion of the head of the retort, in the form of a compact, crystalline, colourless, transparent ring half a centimetre thick, whilst the head and neck were filled with chloride of ammonium, as a fine dust of a dazzling whiteness. Both exhaled a strong ammoniacal smell.

Before being used to determine the proportional ratios, the compact and the powdered chloride were heated in the same apparatus in which they were weighed, until they gave off vapours of sal ammoniac, so as to eliminate the last traces of condensed ammonia.

* Zinc may be deprived of carbon by fusion with 5 per cent. of its weight of litharge. The alloy of zinc and lead thus produced is as effectual in reducing nitrite of potassium in the presence of iron as pure zinc. In the presence of dilute sulphuric and hydrochloric acids, it disengages hydrogen with great facility.

Preservation of Sulphuretted Hydrogen Solution in the Laboratory.

At the last meeting of the Pharmaceutical Society of Paris, M. Lepage, of Gisors, brought forward a process which he has adopted for preserving solutions of sulphuretted hydrogen. All chemists know that this useful reagent cannot be preserved long in aqueous solution. The author has adopted for some years an artifice which enables sulphuretted hydrogen solution to be kept for twelve or fifteen months with scarcely any loss of strength. Instead of using water, he saturates a mixture of equal parts of pure glycerin and water with sulphuretted hydrogen gas, and uses it in the ordinary manner. None of the reactions are interfered with in the least, whilst the solution possesses almost perfect stability. The dilute glycerin dissolves less gas than distilled water will; representing the solubility in the latter liquid by 100, that in the former will be 60.

Glycerin likewise prevents solution of sulphide of ammonium from becoming coloured, and M. Lepage believes that it has a similar action on the sulphides of potassium and sodium.

TECHNICAL CHEMISTRY.

On the Discovery of Sulphate of Strontium in Upper Silesia, and its Application in Agriculture, by Geo. Lunge, *Ph.D.**

The following fact may not be quite uninteresting to such of the readers of this journal as work in agricultural chemistry. In a locality in Upper Silesia there is found a stratum of an earthy mass, similar in colour to chalk, but crystalline under the microscope, which had been taken by the farmers of the neighbourhood for a kind of marl containing gypsum. Many hundred tons of it have been used for years as a manure, and with the best success. Quite lately Professor Krocker, of Proskan, got a sample of this mass, and found it to contain—

	Per cent.
Sulphuric anhydride	36·00
Strontia	46·57
Lime	1·80
Magnesia	1·60
Potassa	0·50
Chloride of sodium	0·25
Carbonic anhydride	1·40
Phosphoric anhydride	0·10
Silicic anhydride	2·10
Alumina and ferric oxide	3·60
Clay, sand	4·28
Moisture and organic substances	1·80
	100·00

The mineral is, then, essentially sulphate of strontia,

* Communicated by the author.

and it is remarkable that it has proved of some value as a manure, notwithstanding the very slight solubility of that body, and although it cannot be supposed that strontium can absolutely substitute calcium in the plants.

On the Waste of Materials in the Alkali Manufacture, by James Hargreaves.*

In the manufacture of carbonate and hydrate of soda from its sulphate there is a very considerable loss of material, which renders the actual produce very considerably less than is indicated by theory. This loss of course varies in different manufactories, according as care and skill are exercised to reduce it, or the work is carried on carelessly and at haphazard. The reduction of this loss is not only of individual, but of national importance, inasmuch as the glass, soap, paper, and other manufactures having the most immediate influence on civilisation and comfort, depend for their existence and extension on a large and cheap supply of this alkali. The usual method of estimating the alkali produced from the crude sulphate of soda or "salt cake" is to multiply the weight of soda ash produced from every 100 tons of salt cake by the percentage of alkali contained in it, and divide these integers by some standard number—say, 48, 50, or 52, which gives the number of tons of ash of the standard strength from each 100 tons of salt cake used. Theoretically, 100 tons of salt cake containing 96 per cent. of sulphate of soda, or 42 per cent. of the base, should produce 84 tons of soda ash of 50 per cent. The following list of practical results shows how different manufacturers fall short of the theoretical yield :—

	Ash from 100 parts of salt cake.	Standard percentage of ash.	Equal to alkali produced per cent.	Total loss per cent
Soda-ash	75	50	37·5	10·72
	70	52	36·4	13·44
	70	50	35·0	16·66
	66·66	52	34·67	17·46
	70	48	33·6	20·00
	66·66	50	33·33	20·65
Caustic soda	57·5	60	34·5	17·86
	55	60	33·0	21·20
	50	60	30·0	28·57

The sources of this loss are as follows :—

1. **By soda salts carried mechanically into the flues and chimney.** — I am not aware that any attempts have ever been made to ascertain the quantity thus carried away, but it must be very considerable, more than is generally suspected. Where salting pans are used, and the hot gases from the black-ash furnace are passed over the crude soda solution to partially carbonate and dry it to "salts," this salt and the "red liquor" drawn along with it generally contain from 0·25 to 1 part of sulphate of soda to every 100 parts of available alkali, more than is contained in the crude soda liquor when run into the pan; the proportion varying with the elevation of the furnace bed, the intensity of the draught, and the mechanical division of the sulphate. But this does not represent the whole of the sulphate thus carried away unutilised, the finer particles being carried beyond the pan into the flues and chimney. In the "finishing furnace," where the "black-ash salt" is heated to dull redness, to expel water, burn out carbonaceous matters, and oxidise the sulphide of sodium present, converting it into sulphate of soda, there is also a small quantity carried away in this manner, as is shown by the glazing of the bricks and deposit of alkaline dust in the flues.

2. **By volatilisation of sodium salts.**—A more considerable loss of material is sustained by the volatilisation of sodium, principally as sulphide and carbonate. The workman generally prefers to work with his furnace very hot, so as to get out his complement of "balls" as soon and with as little labour as possible. The temperature of the furnace is generally below the boiling point of any of the sodium salts present, but when a rapid current of hot gas is passing over and given off from the materials, these salts are absorbed and carried off as vapour, the action of the hot gas in this case being analogous to that of a current of air in drying up water or other volatile fluids when far below their boiling-points. When the door of the lower bed of the furnace is opened while the temperature is high, a white cloud, containing sulphate and carbonate of soda, may be seen rising from the bed. The sulphate is produced by the oxidation of volatilised sulphide, in consequence of the in-rush of cold air through the door, which at once oxidises the sulphide and condenses the alkaline vapours by reduction of temperature. The practical difficulties of the work have so far prevented the estimation of this and the former sources of loss, but comparison of the materials put into and drawn from the furnace leave no doubt that it is very considerable, and varying with the temperature at which the furnace is worked. There is no advantage except that of saving labour and time to the workman in having the temperature higher than is necessary to reduce the sulphate of soda, and cause the sulphide of sodium and carbonate of lime to react on each other. When the temperature is maintained too high, there is not only a great loss by volatilisation, but the increased quantity of fuel used for the purpose is thrown away, the furnace is prematurely worn out, and there is formed at very high temperatures an allotropic sulphide of sodium, which does not react on the lime present in the charge.

3. **By combination of soda with the materials of the furnace.**—This is another, but comparatively small, source of loss. The bricks, &c., taken from the furnace while undergoing repair hold in combination a considerable amount of soda, being in some pieces 6 per cent. and upwards, but in an insoluble condition, and therefore unavailable. The fused sodium salts which have filtered into the interstices of the furnace are also of no practical utility.

4. **By the formation of insoluble compounds of soda,** which, by rendering impossible the extraction of the alkali by lixiviation, still further diminishes the yield. The small coal, which is used as a reducing agent, invariably contains more or less ash, varying from 1·5 to 8 per cent. Of this ash silica and alumina form a large proportion, seldom less than 80 per cent. of the whole. The salt cake contains from 0·12 to 0·5 per cent. of silica and alumina, and the limestone from 0·2 to 3 per cent. These form with soda a compound silicate, which is sparingly soluble in a solution of caustic soda and sulphide of sodium. When the crude soda solution is oxidised, and the sulphide converted into hyposulphite, sulphite, or sulphate of soda, or when it is exposed to a temperature of 212° F., the alumino-silicate is precipitated. In the oxidising apparatus described in the Chemical News, No. 340, the precipitate is in the form of a white powder; and in oxidising towers, where the solution is oxidised by running it over pieces of coke, to expose a large surface of the fluid to the action of the atmosphere, the alumino-silicate is deposited on the coke, filling up its interstices, and if not frequently disturbed by taking the coke out at the bottom of the tower

* Communicated by the author.

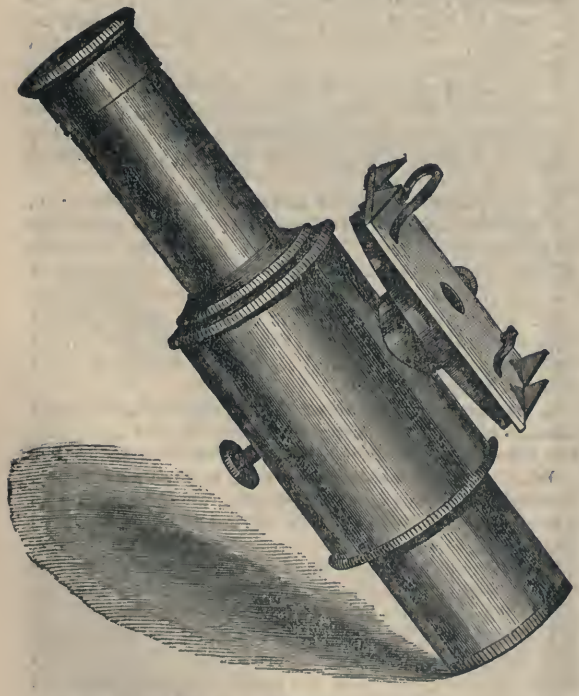
washing and returning it to the top, the whole is in time converted into a firm cohesive mass. Another compound silicate of soda and lime is formed when the silica is in excess of what is required to form the alumino-silicate, and is quite insoluble. The loss from this cause is variable in proportion to the quantity of alumina and silica introduced along with the materials used and the quantity of these substances taken from the bricks of the furnace.

(To be continued.)

PHYSICAL SCIENCE.

On a New Micro-spectroscope, and on a New Method of Printing a Description of the Spectra seen with the Spectrum Microscope.

IN the CHEMICAL NEWS for April and May, 1865,* Mr. Sorby, F.R.S., described his application of spectrum analysis to microscopical investigations, and especially to the detection of blood stains. For the purpose for which it was intended, this arrangement was excellent, but in general practice it was in some respects inconvenient. Mr. Browning has recently made for Mr. Sorby a modification of the spectroscope, which is intended to slip into the eye end of a microscope instead of the eyepiece. The instrument is shown in the accompanying figure. It



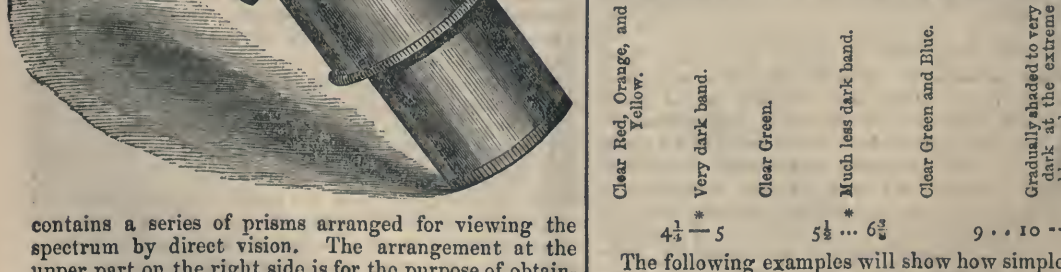
contains a series of prisms arranged for viewing the spectrum by direct vision. The arrangement at the upper part on the right side is for the purpose of obtaining a supplementary spectrum from any object whose spectrum it is desired to compare with that of the object placed on the stage of the microscope. This object may be either a solution of permanganate of potash in a small sealed tube, a cobalt blue glass, or anything else which will furnish a standard spectrum for comparison. There are milled heads with screw motions to adjust the focus of the different parts of the spectrum, and to open and shut the slit vertically and horizontally. Powers of from half an inch to $\frac{1}{20}$th may be employed, and by using a binocular microscope the object may be brought into the field, and examined in the ordinary way through one tube, whilst its spectrum may be observed and compared with that of a standard light by means of the other tube. The object may be illuminated either by transmitted or reflected light, and any of the ordinary accessories may be used for this purpose, such as a chromatic condenser, side reflector, Lieberkuhn, &c.

Mr. Sorby has also introduced a standard spectrum, which he proposes should be used as a scale in all descriptions of spectra, as seen by the spectrum microscope. Mr. Sorby has been good enough to communicate to us the following description of this valuable method:—

The scale adopted is an interference spectrum, produced by a plate of quartz ·043 inch thick, cut parallel to the principal axis of the crystal, and placed between two Nicol's prisms. In this the whole visible space is divided by dark bands into twelve regular divisions, having in all parts the same relation to the physical properties of the light. These are counted from the red end towards the blue, their centres being reckoned as 1, 2, 3, &c., and the thickness of the plate is so adjusted that the sodium line exactly corresponds to $3\frac{1}{2}$. The intensity of the absorption is expressed by the following types:—

Not at all shaded		Blank space
Very slightly shaded	. . .	Dots with wide spaces
Decidedly shaded	. . .	Dots closer together
More shaded	...	Very close dots
Strongly shaded, but so that a trace of colour is still seen	---	Three hyphens close
Still darker	—	Single dash
Nearly black	——	Double dash

Except when specially requisite, only the symbols . . . --- — are employed for the sake of simplicity, and then as signs of the relative rather than of the absolute amount of absorption, and it is assumed that there is a gradual shading off from one tint to the other, unless the contrary is expressed. This is done by means of a small vertical line over the figure (see No. 11), which shows that there is a well-marked division between them. Definite narrow absorption bands are indicated by * printed over their centre. This will be better understood by a description of the spectrum of deoxidised hæmatin.


Clear Red, Orange, and Yellow.
Very dark band.
Clear Green.
Much less dark band.
Clear Green and Blue.
Gradually shaded to very dark at the extreme blue end.
4½ — 5
5½ ... 6⅝
9 . . 10 --- 11—

The following examples will show how simple or more complicated spectra may thus readily be printed and compared. I have chosen solutions of similar tint, in order to show that the spectra of those of nearly the same colour may be very different, or, if analogous, may differ in details, easily expressed by the symbols. The colour of each is given after the name. Nos. 1, 8, 9, 10, 11, 12, and 13 can be kept for a long time, sealed up in tubes, and the rest are easily prepared.

* CHEMICAL NEWS, vol. xi. pp. 186, 194, 232, and 256.

. Cudbear in alum (pink): 3 ..... 8 11 . —

. Colour of elder berries with citric acid (red pink):—

4 . - 5½—8 - - 9 . . . 11 - —

3. Brazil wood with bicarbonate of ammonia (pink):—

$$4\tfrac{1}{2} \overset{*}{—} 5\tfrac{3}{4} \cdots\cdots 8$$

. Logwood with bicarbonate of ammonia (pink):—

$$3\tfrac{5}{8} \overset{*}{—} 5\tfrac{1}{4} \cdots\cdots 7$$

The next four are spectra of blood, produced by the successive addition of the various reagents, as in detecting fresh stains.

5. Fresh blood (pale scarlet):—

$$3\tfrac{1}{2} \overset{*}{—} 4\tfrac{3}{8} \quad 4\tfrac{3}{4} \overset{*}{-} 5\tfrac{3}{4} \quad 7 \cdot \cdot 8 - 9—$$

6. Citric acid then added (pale brown):—

$$1\tfrac{5}{8} \overset{*}{\cdots} 2\tfrac{1}{4} \quad 4 \cdots 8 \cdots 9 --- 10—$$

7. Ammonia then added (pale brown):—

$$3\tfrac{5}{8} \overset{*}{\cdots} 4\tfrac{3}{8} \quad 4\tfrac{7}{8} \overset{*}{\cdots} 5\tfrac{5}{8} \quad 7 \cdot \cdot 8 --- 10—$$

8. Deoxidised hæmatin, from blood stain two years old (pink):—

$$4\tfrac{1}{4} \overset{*}{—} 5 \quad 5\tfrac{1}{4} \overset{*}{\cdots} 6\tfrac{3}{8} \quad 9 \cdot \cdot 10 --- 11—$$

With these may be compared the two spectra which more nearly resemble those produced by blood than any I have yet seen.

9. Cochineal in alum (pink):—

$$3\tfrac{3}{8} \overset{*}{—} 4\tfrac{1}{4} \cdots 5\tfrac{1}{8} \overset{*}{---} 6\tfrac{1}{8} \cdots 7\tfrac{1}{2}$$

10. Alkanet root in alum (pink):—

$$3\tfrac{1}{4} \overset{*}{—} 4\tfrac{3}{8} \quad 5\tfrac{1}{4} \overset{*}{\cdots} 5\tfrac{3}{4}$$

The following spectra of compounds derived from chlorophyll are as complicated as any I have met with.

11. Normal chlorophyll in alcohol (deep green):—

$$\tfrac{7}{8} \overset{*}{—} 2\tfrac{3}{8} --- 3\tfrac{1}{4} \cdots 4\tfrac{1}{2} \quad 6\tfrac{3}{4} \cdot --- 7\tfrac{1}{2}—$$

12. Ditto, as decomposed by acids, or as found in some leaves (olive green):—

$$1 \overset{*}{—} 2\tfrac{1}{8} \quad 2\tfrac{3}{4} \overset{*}{---} 3\tfrac{3}{8} \quad 4\tfrac{1}{4} \cdots 5\tfrac{1}{4} \overset{*}{---} 5\tfrac{3}{4} \cdots 6\tfrac{3}{8} \overset{*}{---} 7\tfrac{3}{8} \quad 8\tfrac{1}{2} \cdot \cdot \cdot 9\tfrac{1}{2}—$$

13. Ditto, as decomposed by caustic potash, and then by hydrochloric acid (red-green, neutral tint):—

$$\tfrac{1}{4} \overset{*}{—} \tfrac{3}{4} \quad 1\tfrac{1}{8} \overset{*}{—} 1\tfrac{3}{8} \quad 1\tfrac{7}{8} \overset{*}{—} 2\tfrac{1}{8} \quad 4\tfrac{1}{2} \overset{*}{---} 5\tfrac{1}{4} \cdots 9 \cdot \cdot 10—$$

These instruments and methods were exhibited and explained by Mr. Sorby and Mr. Browning at the last *soirée* of the Royal Society, where they excited the greatest interest.

Cleaning Glass.—A method of cleaning glass, which may be useful where other methods fail, is given in the appendix to the second edition of Major Russell's "Tannin Process," published by Robert Hardwicke, Piccadilly. Dilute the ordinary hydrofluoric acid sold in gutta-percha bottles, with four or five parts of water, drop it on a cotton rubber (not on the glass), and rub well over, afterwards washing till the acid is removed. The action is the same as that of sulphuric acid when used for cleaning copper; a little of the glass is dissolved off, and a fresh surface exposed. The solution of the acid in water does not leave a dead surface on the glass, as the vapour would; if a strong solution is left on long enough to produce a visible depression, the part affected will be quite bright. This method is recommended in some cases for cleaning photographic plates, but we should think it might also be useful in cleaning the insides of bottles, flasks, &c., which have got stained through use.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, May 1, 1867.

I am now enabled to send you a list of prizes to be awarded by the Society of Encouragement, Paris, and their dates. The aim of the Society is the close alliance between practice and theory. It represents invention, improvement, and application. Every new discovery or invention to ameliorate the state of our national industry emanates from this Society. It makes no distinction between the high-placed theorist and the practical man; those who work in a laboratory, in the study of a *savant*, in a workshop, or as labourers, all are equally welcome and of the same grade. The value of the prizes exceeds 6000*l*. The Society does not confine itself, in their distribution, to industrial matters; it extends its recompenses to individuals. Foremen, workmen in manufacture and agriculture, inventors, pupils of industrial schools, persons invalided by work of hand or brain, receive encouragement, recompenses, and *substantial* aid.

Grand Medals.—Gold medals of 40*l*. to French or foreign inventors who have made the most important discoveries applicable to French industry, to be distributed annually in the following order:—1867, Commerce, bearing the profile of Chaptal; 1868, Fine Arts, that of Jean Gougon; 1869, Mechanical Arts, Prony; 1870, Chemical Arts, Lavoisier; 1871, Agriculture, Thénard; Economical and Physical Arts, Ampère.

Grand Prize of 480*l*.—This is given by the Society to the author of a discovery deemed to be the most useful to French industry.

Prize given by the Marquis Argenteuil.—The same amount as the last, awarded to the discoverer of a special invention or improvement, principally with regard to objects in France which have not been yet able to compete with foreign markets, either as to quality or cheapness.

Prizes for 1868, 1869, 1870, 1871, 1872, 1873, *and* 1874.

Mechanical Arts.—Prize of 120*l*. for the best machines for steam navigation, which, with slight draught of water, can enable the machinery and coaling room to be diminished, and thus increase the available space; 1869.

Prize of 120*l*. for a locomotive able to take a goods-train at the rate of thirteen to eighteen miles an hour, with a minimum of expense of prime cost and combustion of fuel; 1870.

Prize of 240*l*. for a motor engine, from 25 to 100-horse power, burning at the most 1½ lb. of coal of best quality per indicated horse-power, weighing less than 661 lbs., and costing from 12*l*. to 16*l*. per horse-power; 1871.

Prize of 40*l*., founded by the Princess Galatzin, for a hydraulic motor for a small workshop, able to work a shaft representing a force of 6 to 20 kilogrammetres* per second; 1868.

Prize of 160*l*. for improvements to be effected in the mechanical weaving of linen and hempen goods; to be awarded in 1872, in favour of the manufacturer who can produce commercially linen threads of a fineness of 100 metres to the gramme, or hemp threads 15 metres. This must be obtained by an economy of at least 15 per cent. of the motive power, and with such a diminution of temperature that there is little or no steam. The manufacturer must have delivered to commerce at least the value of 800*l*. worth of threads of linen or hemp, according to the above-stated conditions.

Prize of 120*l*. for a file-making machine able to cut all sorts; 1870.

Prize for a practical and economical means of cutting mill-stones, whilst diminishing the insalubrity of this branch of industry; 1869, or, if necessary, 1875.

* A kilogrammetre is a kilogramme (2·205 lb.) raised to the height of a metre in one second.

Prize of 80*l.* for a water-meter, acting under a pressure of from 1 to 5 atmospheres with a temperature of 0° to 100° C., and giving the volume of water to within a hundredth part; 1870.

Prize of 40*l.* for a regulator for gas burners.

Chemical Arts.—Prize of 80*l.* for the best process of making oxygen on a large scale; 1869.

Prize of 120*l.* for the industrial application of oxygenated water.

Prize of 80*l.* for extracting the nitrogen of the air in the form of nitric acid or ammonia; 1869.

Prize of 80*l.* for the economical production of cyanide by the nitrogen of the air; 1871.

Prize of 120*l.* to be awarded (1870) to the manufacturer who shall be the first to produce sulphuric acid, quite free from arsenic, from pyrites.

Prize of 40*l.* for the industrial employment of any cheap and abundant mineral; 1868.

Prize of 40*l.* for the utilisation of the refuse of factories; 1869.

Prize of 40*l.* for the useful application of the newly-discovered metals; 1870.

Prize of 40*l.* for new applications of simple substances, non-metallic; 1870.

Prize of 40*l.* for the discovery of a new alloy useful in the arts; 1871.

Prize of 120*l.* for the artificial production of graphite for the fabrication of pencils; 1872.

Prize of 120*l.* for the artificial preparation of the compact black diamond; 1873.

Prize of 160*l.* for the discovery of processes capable of furnishing, by any organic transformations, useful substances, such as quinine, indigo, alizarine, or cane sugar.

Prize of 160*l.* for the artificial production of fatty acids and of waxy substances.

Prize of 240*l.* for a theory of cast steel founded on certain experiments; 1872.

Prize of 120*l.* for the disinfection of the refuse from the purifying of gas; 1869.

Prize of 40*l.* for a process capable of disinfecting and clarifying, quickly and durably, sewage water; 1868.

Prize of 60*l.* for the discovery of an ink which will not rust metallic pens; 1869.

Prize of 120*l.*, 60*l.*, and 20*l.*, for the employment of boracic acid and borax in the ceramic arts; 1868.

F. Moigno.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Group VI. — Class 44: Chemical and Pharmaceutical Products—Industry of Colouring Matters extracted from Coal.

This great industrial art, illustrated for the first time at the International Exhibition of 1862 with great *éclat*, has not ceased to develope itself, less, however, in France than in Switzerland and Germany, where the progress has been considerable. With us progress was fettered by the fact that aniline red, the basis of all the other colours, was the exclusive property of the Fuchsine Company, and was, in consequence, a general monopoly. The great problem under these conditions was to arrive by direct process at violet, blue, and green colours without passing through the red; it has at length been resolved for violet by MM. Poirrier and Chappat, jun., of Saint Denis, with the able assistance of their chemist, M. Bardy. The methylaniline and dimethylaniline violets, exhibited under the name of "Paris Violet," are the gems of the chemical section, and have most attracted the attention of practical men, also of the jury, who have awarded them a gold medal.

Before describing this discovery, we may remark that the Fuchsine Company have kept up their reputation, and that the display in their glass case is really magnificent; their sphere of radiating crystals, so sharp and voluminous, of chlorhydrate of rosaniline, along with all the salts of rosaniline, have a wonderful effect. They find a powerful rival, however, in M. Müller, of Basle, who also exhibits a large collection, the principal article being a cup containing a pound of rosaniline so pure that it is almost colourless. We have not found chrysotoluidine or malvaudine except on stuffs of silk and cotton, of which specimens are exhibited by MM. Hucotte and Berryer, also the blues of MM. Girard and Laire, the process of which shall be described presently.

The Paris violet, by M. Poirrier and Chappat, No. 23, Rue d'Hauteville, stall No. 2, is produced from the methylaniline and dimethylaniline which Dr. Hofmann discovered and made known by a process very costly and not put into practice. The celebrated chemist employs as a reducing agent the very volatile iodide of methyl, and this would have entailed a considerable loss if 800*l.* per day were constantly risked—that being the quantity necessary to produce 150 kilogrammes of methylaniline that MM. Poirrer and Chappat send to the market every day. In order to arrive at a remunerative product, they have substituted a cheaper substance, nitrate of methyl, for the iodide; it is by this means that they were able to produce their first *ton* of Paris violet at their chemical works. Still this mode of fabrication was fraught with danger, and was discontinued. Happily, M. Berthelot pointed out a process less dangerous and cheaper, the treatment of ammonia by alcoholic radicals.

To obtain methylaniline or dimethylaniline, MM. Poirrer and Chappat place in contact in a closed vessel, at a high temperature, and under pressure, aniline and hydrochlorate of aniline, or methylaniline and hydrochlorate of aniline; and this process, which has required the construction of special apparatus, the application of means for regulating the reaction in order to obtain at will either methyaniline or dimethylaniline, &c., works at present with perfect regularity; they have even extended, with success, the process towards the preparation of other alkaloids based on an alcoholic radical. There remained yet the means of converting methylaniline and dimethylaniline into violet, soluble in water, as there is no complete success without this condition. New agents had to be searched for, that do not require a too high temperature, in order to produce the reduction, or the return would not be so great, nor the colour so bright or of so decided a shade. They finished by transforming the perfectly pure methylaniline from toluidine into violets of all shades not inferior to those derived from the rosaniline of Hofmann.

MM. Tessié de Mothay and Maréchal, of Metz, exhibit a new process for bleaching fibres, threads, and woven stuffs of cotton, hemp, linen, wool, and silk.

The fibres, threads, and tissues contain two sorts of colouring matters—one soluble, after oxidation, in alkaline lixivia; the other substances inherent to the cellulose, which should be bleached by the oxygen of the air and light, or by chemical compounds able to disengage oxygen in its nascent state.

The methods hitherto employed for bleaching or decolorising tissues depend upon the alternate application of two sorts of agents—1. Oxidising substances; 2. Solvents.

But these methods, perfect as they are in their way, have the following faults:—The employment of an oxidising agent which acts with extreme slowness when it is taken from the atmosphere, or with a destructive combustible power when it is several times placed in a medium containing chlorine or the chlorated compounds, such as the hypochlorites, for example; the use of alkaline solvents which act with extreme slowness in dissolving the quantity of colouring matter altered by the oxidising agents. For these latter the most suitable substitutes are—1. Permanganic acid, produced by the decomposition of the permanganates by means of hydrofluosilicic acid. 2. The alkaline

permanganates, with the addition of chlorides, sulphates, and alkaline fluosilicates capable of forming salts, having for base permanganic acid, at the moment when this acid is decomposed by the fibres; passing, themselves, into a basic state, as is shown presently.

In order to employ practically the oxidising agents and solvents above mentioned, the operation is thus:—

For bleaching stuffs or threads of cotton, linen, or hemp, all the grease or fatty matter is extracted by an alkaline bath. They are then steeped in a solution of permanganic acid or permanganate of soda, with the addition of sulphate of magnesia. Afterwards (fifteen minutes' interval generally) the substances to be bleached are removed and transported either into alkaline solutions or into baths containing sulphurous acid, nitrosulphuric acid, or peroxide of hydrogen.

In the first case the substances are heated to boiling-point in alkaline solutions for several hours until the oxide of magnesia which covers them is partially or wholly dissolved.

In the second case the substances to be bleached are steeped in baths containing either sulphurous acid or nitrosulphuric acid or oxygenated water, until the layer of oxide of manganese, with which they are coated, is entirely dissolved; after this they are washed and resteeped, first in a solution of permanganic acid or the permanganate, afterwards in alkaline solutions or in the solvents above mentioned, and so on till the bleaching is completed.

A bleaching-bath, containing, according to the nature of the fibres or tissues to be bleached, from 2 to 6 kilos. of permanganate of soda, is sufficient to bleach effectually a hundred kilos. of cotton, hemp, or flax, raw or woven.

This method of bleaching is the same for wool and silk, except that the alkaline liquid is a weak solution of soap, and sulphurous acid is alone employed.

The industrial results obtained in the factory of M. Verlay, at Comines (Nord), by the above-mentioned process show that hemp and linen threads are completely bleached without alteration in one day; that their tissues are bleached in three days; that the cost for complete bleaching is on an average 3½d. the kilo. for threads, and 5s. per 100 metres for the woven stuffs.

By the present methods of bleaching, even the most rapid and economical, for all textile substances or tissues, threads require, according to the daylight and weather, at least fifteen days and at most thirty; tissues from thirty to sixty days. Also the cost of bleaching, on the other hand, amounts in similar cases to about 4½d. per kilogramme for threads and 7s. 6d. per 100 metres for tissues.

In order to obtain the practical result which we have just mentioned, new economical processes were necessary to be found:—1. The production of manganate of soda; 2. To transform this manganate into permanganate.

Lastly, we mention that manganate of soda is now prepared and sold at the rate of one franc per kilogramme to bleachers.

Its transformation into permanganate is easily and cheaply made, either by means of sulphate of magnesia, chloride of magnesium, or chloride of calcium.

The following formulæ show the transformation:—

$$3(KO,MnO_3) + 2(MgO,SO_3) =$$
$$= KOMn_2O_7 + 2(KO,SO_3) + 2(MgO,HO).$$

A Quinine Famine.—The following is an extract from a letter from Mr. Colville Barclay, President of Poor Relief Committee of the Island of Mauritius: "The mortality from the effects of fever just now is from 180 to 200 every day throughout the island. All the quinine in the place is finished, and half a dozen bottles received fom Reunion last week were sold at 135 dollars the ounce (27*l.* 10s.). The doctors are using arsenic as a substitute. The Government has sent home for 30 lb. of quinine, as well as to Ceylon and the Cape for all that can be obtained."

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, April 18.

Dr. J. H. Gladstone, F.R.S., Vice-President, in the Chair.

In continuation of our report of last week, we now give an account of the papers read by Mr. Chapman, and of the short communication from Dr. F. C. Calvert.

The first, entitled "*Oxidation of the Acids of the Lactic Series*," by Messrs. E. T. Chapman and Miles H. Smith, asserts that the acids of this series may be divided into two classes, according to the nature of the products of oxidation which they respectively furnish; the first containing hydrogen and an organic radical, giving rise to the formation of aldehydes, whilst the secondary acids, containing two organic radicals, produced ketones. Dimethoxalic acid yielded, on oxidation, acetone and carbonic acid, and ethomethoxalic acid (prepared from the corresponding ether of Frankland and Duppa) gave carbonic acid and methylated acetone, boiling at 82—83° C., and having a fragrant odour, very similar to propione. Of this compound an analysis was made, which furnished results in close accordance with the numbers demanded by theory. Like common acetone, it combines with alkaline bisulphites, but with more energy, evolving a considerable amount of heat, and forming a compound which is very soluble in water. On further oxidation of this substance nothing but acetic acid was produced. Similar results were obtained in the oxidation of diethoxalic acid. The authors recommend a resort to this method for the easy preparation of the ketones, and, finally, propose by this means to investigate problems of isomerism occurring amongst the fatty acids, illustrations of which are sketched in the paper.

The Chairman insisted upon the value of an extended optical method of research carried out in conjunction with the principles indicated by the authors in this communication.

A preliminary note "*On Limited Oxidation with Alkaline Permanganate*," by the same authors, was then read. The authors point out the differences in the products of oxidation of common alcohol by the use of acid and alkaline solutions of permanganic acid; thus, whilst, in the presence of sulphuric or other mineral acid, a mixture of aldehyde and acetic acid is produced, on the other hand, in an alkaline solution nothing but oxalic acid is formed. Lactic acid under like circumstances gave similar results. So that much depends upon the maintenance of unalterable conditions during the progress of oxidation with permanganate of potash, and the authors submit that Truchot's and Berthelot's anomalous results obtained in the examination of amylene are attributable to a want of appreciation on their part of this fact. The authors described a method of distinguishing between tartaric and citric acids, founded upon the circumstance that the latter acid does not carry the reduction further than the green manganate in a strongly alkaline solution, whilst tartaric acid furnishes the brown hydrated binoxide.

The Secretary then read a paper by Dr. F. Crace Calvert, "*On the Presence of Soluble Phosphates in Cotton Fibre, Seeds, &c.*" The author points out the fact that seeds contain relatively more mineral phosphates than other parts of the plants upon which they are borne, and alludes to the common practice of burning off the organic matters before proceeding to search for the phosphates therein contained. From his experiments Dr. Calvert has, however, been led to conclude that the whole of the phosphoric acid or phosphates is merely held mechanically distributed throughout the organic tissue, and in such a condition that they may be wholly extracted by the action of water. Cotton yarn steeped for several hours in

distilled water furnished a solution containing appreciable quantities of phosphoric acid, lime, and magnesia, and quantitative experiments were made upon seven characteristic varieties of cotton, which had been carefully prepared and carded in Manchester, for the purpose of determining the extent to which the phosphates could be removed by washing. The results showed by the uranium process amounts varying between ·035 and ·055 per cent. of phosphoric acid thus dissolved, whilst traces only of this constituent could be detected in the ash left upon burning the washed and dried cotton. Similar experiments made upon wheat, French beans, and walnuts gave like results, much phosphoric acid and magnesia being discovered in the aqueous solution. The author promises to continue these researches and communicate the results.

The Chairman moved a vote of thanks in favour of the authors, and adjourned the meeting as already reported.

ROYAL SOCIETY.

Thursday, May 2, 1867.

At the usual weekly meeting this evening the President read from the chair the names of the following fifteen candidates recommended by the Council for election. They will be balloted for on June 6:—William Baird, M.D.; W. Boyd Dawkins, Esq.; Baldwin Francis Duppa, Esq.; Albert C. L. G. Günther, M.D.; Julius Haast, Esq., Ph.D.; Captain Robert Wolseley Haig, R.A.; Daniel Hanbury, Esq.; John Whitaker Hulke, Esq.; Edward Hull, Esq.; Edward Joseph Lowe, Esq.; James Robert Napier, Esq.; Benjamin Ward Richardson, M.D.; J. S. Burdon Sanderson, M.D.; Henry T. Stainton, Esq.; Charles Tomlinson, Esq.

QUEKETT MICROSCOPICAL CLUB.

The usual monthly meeting was held at University College on the 26th instant, Mr. Ernest Hart, President, in the chair.

Dr. Halifax described his ingenious method of obtaining thin sections of insects, soft vegetable tissues, minute seeds, &c., by immersion in wax, and afterwards slicing them upon the ordinary section table.

Mr. Higgins gave a lengthened and interesting description of the "otolithes" or earbones of fishes, to the study of which he has devoted himself with remarkable industry for the last eighteen years. The result of many thousand examinations of fossil and recent fish has enabled him with positive accuracy to identify species, and in many instances genera. His remarks were illustrated by an extensive series of "otolithes," which were displayed in cases in the room, containing specimens obtained from the largest to the smallest fish, both freshwater and marine.

The meeting, which was attended by upwards of 130 members and their friends, terminated with a *conversazione*.

Eight members were elected.

ACADEMY OF SCIENCES.

April 29, 1867.

(From our own Correspondent.)

The sitting of the Academy was very short to-day.

Sir David Brewster presented the opening discourse which he had made at the Edinburgh Royal Society.

M. Baer, of St. Petersburg, warmly thanked the Academy for having given him the Cuvier prize of 1866.

M. Baumhein, present at the meeting, called the attention of a considerable number of members, particularly M. Fizeau, to a forgetfulness on the part of the commission appointed to award the prize for the determination of the length of the waves of the solar spectrum. He deeply regretted that they had not known the remarkable memoir of M. van der Willigen, director of the Teyler Physical Cabinet at Haarlem, which was more complete than that of M. Mascart in 1866.

M. Dumas read a letter, in which M. Pasteur, at present at Alais, and who is finishing his experiments and observations on the precocious rearing of silkworms, announced an important discovery made by him. The organisms that he terms *corpuscles* are propagated, or at least multiplied, by *scissiparity*. They contain a sort of kernel, which ordinarily presents the first indications of scissiparity. M. Pasteur has examined under the microscope the corpuscles of the internal mucous coats of the stomach and the kernels, at all states of division, commencing, in progress, or terminated.

M. Dumas, in the name of M. Naquet, presented the second edition, in two volumes, of his "Principles of Chemistry founded on Modern Theories." It is a well-written work, quite up to the modern progress of science. M. Dumas, however, reproaches the author with having regarded facts too much in a personal light, and enumerating the results without mentioning the processes. Formerly, said the celebrated chemist, the processes were an important item in the teaching of chemistry: and also he has further remarks to make on this reserve, which he will make on a future occasion.

M. Fremy presented a memoir on "*Phenol*," in which M. Dussard announced that he had succeeded in perfectly and easily producing the phenaphtic acid of Berzelius, and preparing diatomic phenol possessing very remarkable properties, and which will bear the same relation to the monatomic phenol as the glycol of M. Wurtz bears to monatomic alcohols.

M. Henri Sainte-Claire Deville presented a note, by M. Cailletet, on an amalgam of sodium with which he has already obtained considerable success. He called to mind the important results obtained by the modern researches of Messrs. Crookes, Matthiessen, Regnault, &c., on alloys. Mr. Crookes, for example, had rendered great service to metallurgical operations by proving that the addition to mercury of a small quantity of sodium renders incomparably more easy and profitable the extraction of the precious metals.

Mr. Sterry Hunt read the summary of his researches upon certain reactions of magnesian salts and magnesian rocks. The author attacked the theory of MM. Haidinger and Suckow, who explain the efflorescence of sulphate of magnesia by the reaction of sulphate of lime and carbonate of magnesia. He believes that the magnesian silicates which form portion of the dolomites in the environs of Paris are the representatives of the unaltered formation of steatites; that the talcs and serpentines are formed aqueously; that the greensands of the Paris basin are of the same composition as serpentines, &c.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Bulletin de la Société d'Encouragement. January, 1867.

G. de Claubry: "*Report on Bon's Imitations of Precious Stones.*"—"*Blasting of a Cast Iron Roll by Nitro-glycerine at Rothehutte, Upper Hartz.*"—Putsch and Ziehharth: "*Improved Furnace for Melting Enamel.*"—"*A Method of Gilding Glass.*"—Weber: "*An Account of an Explosion of Picrate of Soda.*"—"*On the Preparation of Aniline Colours in Powder for Printing Carpets, and for Lithography.*"—"*On Colouring Brass.*"—Knaffl "*On Colouring Zinc and Brass Black.*"—Jünemann: "*A new quick-drying Fire and Waterproof Cement.*"—Klezinsky: "*Solution for rendering Fabrics Uninflammable.*"

Le Technologiste. March, 1867.

Soames "*On a Process for Purifying Paraffin.*"—E.

Jacobsen "*On the Use of Rosaniline for Detecting the presence of Free Fatty Acids.*"—"*On the Relative Indications of different Optical Saccharometers.*"—V. Kletzinsky: "*Smechochromasy, a Process of Colouring by means of Coloured Soaps.*"

Journal für praktische Chemie. No. 22. 1866.

A. Muller: "*A Memoir on Chromometrical Analysis.*"—H. Vohl "*On the Action of Fuming Nitric Acid on the Chlorinated Derivatives of Benzol.*"

Nos. 23-24, 1866.—O. E. Erdmann "*On the Formation of Aniline Colours from Protein Substances.*"—A. C. Oudemans, Jun.: "*Chemical Researches on certain East Indian Fats.*"—E. Sell and E. Lippmann "*On the Action of Mercury Ethyl on Monobromoacetate of Ethyl.*"—F. Rochleder: "*Contributions to the Knowledge of Luteoline.*"—H. Ritthausen: "*Researches on some Constituents of Rye;*" "*On a new Compound called by the Discoverer Glutaminic Acid;*" "*On the Constituents of the Gluten obtained from Wheat.*"—A. Claus "*On the Action of Sodium on Oil of Bitter Almonds.*"—W. Körner "*On Brominated Crotonic Acid.*"—O. Hesse "*On Carbo-usnic Acid (Carbo-usninsäure).*"—K. von Hauer "*On a Double Salt of Seleniate of Cadmium and Potash.*"

March 1, 1867.—F. Reindel "*On some Basic Salts of Copper;*" "*On some Double Cyanurates.*"—Rammelsberg "*On Phosphorous Acid and its Salts.*"—P. T. Cleve "*On some Brominated and Iodated Ammoniacal Platinum Compounds.*"—L. Rinman "*On the Presence of Nitrogen in Steel and Pig Iron, and on the Condition of Carbon in Hardened and Unhardened Steel.*"—R. Weber "*On the Formation of Protoxide of Nitrogen by the Action of Sulphurous Acid on Hyponitrous and Nitric Acids.*"—A. Bauer "*On the Action of Chlorine on Amylene.*"—Baeyer "*On the Reduction of Aromatic Compounds by means of Zinc.*"—F. Rochleder "*On Quercitrine.*"—W. Stein "*On the Elementary Analysis of Hygroscopic Substances.*"—C. W. Paykalt "*On the Analysis of some Swedish Minerals.*"

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

218. E. H. C. Monckton, Summer Hill, Birmingham, "Improvements in the manufacture of butter."—Petition recorded January 26, 1867.

952. W. E. Newton, Chancery Lane, "An improved process for manufacturing ice and for other refrigerating purposes." A communication from T. S. C. Lowe, New York, U.S.A.—March 30, 1867.

979. J. Storey, and W. E. Bickerdike, Lancaster, and W. V. Wilson, Jubilee Street, Mile End, Middlesex, "A new method of bronzing metallic and other surfaces."—April 2, 1867.

1044. W. R. Lake, Southampton Buildings, Chancery Lane, "An improved mode of embalming or preserving dead bodies and carcases." A communication from G. W. Scollay, St. Louis, Missouri, U.S.A.—April 6, 1867.

1054. C. F. Claus, Middlesbrough-on-Tees, Yorkshire, "Improvements in the manufacture of chlorine."—April 8, 1867.

1064. J. H. Player, Birmingham, "Improvements in the manufacture of phosphorus and in economising residual products of the said manufacture."—April 10, 1867.

Notices to Proceed.

3293. F. W. Reeves, Cambridge Terrace, Notting Hill, Middlesex, and J. B. Muschamp, Pembroke Road, Middlesex, "An improved explosive substance."—Petition recorded December 15, 1866.

3326. L. Schad, Warrington, Lancashire, "Improvements in treating aniline colours for dyeing and printing."—December 18, 1866.

3348. S. Parry, Thackeray Street, Liverpool, "An improved composition for the coating of the bottoms of ships and other vessels."—December 20, 1866.

3433. J. Napier, Salisbury, Wiltshire, "Improvements in the preparation of food of a substance to be employed in the place of malt, and for the medication of food for animals."—December 29, 1866.

211. J. J. Lundy, Leith, Mid Lothian, N.B., "Improvements in the treatment of the residual matters resulting from and obtained in the purification and distillation of mineral or hydrocarbon oils, and also in the treatment of coal-tar and various waste or other alkaline and lime substances, for the purpose of utilising the same."—January 26, 1867.

CORRESPONDENCE.

Cement Cisterns for Water.

To the Editor of the Chemical News.

Sir,—I find among the answers for correspondents in No. 386 of your valuable paper, an excellent suggestion to J. Y. S. Permit me to call your attention to the use of hot coal tar for preventing the contamination of the water by the cement. It is a cheap and effective means of preventing what is complained of, and is not a fancy. Experiments made by Captain de Bordes, of the Netherlands Royal Engineers, and myself, many years ago, have proved that even from hydraulic cement which sets and hardens in a few hours, for days after lime and other salts are dissolved out by pure distilled water in very appreciable quantity. In the kingdom of the Netherlands, in many parts, and especially in portions of the provinces of Zealand, North Holland, and Friesland, no other water than rain-water is in general use for domestic purposes, because, like as at Amsterdam, Flushing, the Helder, and other places, all the water of canals, rivers, &c., is either brackish or decidedly salt. Large cisterns built underground, in order to prevent foul infiltrations of surface water, but which have to be laid entirely in strong cement (hydraulic as it is termed) are used to keep the rain-water for the use of barracks and large establishments. These cisterns are often lined with Dutch glazed tiles, fixed in cement, but it has been found cheaper to simply line the cisterns with cement, and after it is dry to give two coatings of hot coal tar. I suggested lately the same to an engineer, who, having applied it to a cistern of his own in his house, found it to answer perfectly. For a few days the water had a slight tarry taste, which is now entirely gone. I am, &c. Dr. Adriani.

Drilling Glass.

To the Editor of the Chemical News.

Sir,—In the Chemical News of April 19 there is a description, by Mr. Spencer, of the old and well-known method for drilling glass by means of a file wetted with oil of turpentine. Some years ago I read in a German periodical of another means for the same purpose—viz., dilute sulphuric acid—and I found it, on trial, to answer much better than the first. Not only, it appears, is the efficacy of the cutting tool more increased by sulphuric acid than by oil of turpentine, but also, strange as it seems, the tools (files, drills, &c.) are far less rapidly destroyed by being used with the acid than with the oil. I also found it stated that, in the engineering establishment of Mr. Pintus, at Berlin, glass castings for pump barrels, &c., were drilled, planed, and bored, just like iron ones, and in the same lathes and machines, by the aid of sulphuric acid. As to drilling, I can fully testify to the efficacy of that method. Whenever I want, say, a hole in the side of a bottle, I send it, along with some dilute (1 : 5) sulphuric acid, to the blacksmith, who drills in it, with a hand brace, a hole of ¼-inch diameter. This hole is then widened

to the required size by means of a triangular or round file, again wetted with the acid. I also find a great help in the latter when making graduations on litre flasks, &c. There is hardly any smell perceptible during the work, which proves how little the acid acts upon the tools, undoubtedly owing to their being tempered; but each time after use I take the precaution to wash and dry the files at once, and I have so far observed no sensible deterioration in them. Hoping this little hint may be useful to some of your readers, as it has been to me, I am, &c.

G. Lunge, Ph.D.

South Shields, April 20.

Extinction of Fires.

To the Editor of the Chemical News.

Sir,—In papers dated Sydney, February 16, I find an account of a patent taken out by Dr. Bland for a method of extinguishing fires in ships' holds and other confined spaces by means of carbonic acid gas. The patentee states that his attention was directed to the subject by the loss of a ship by fire in 1839, and now, after twenty-eight years of, no doubt, laborious experiments, he brings forth the following original process. He places on the kelson of a vessel a number of barrels containing calcareous minerals, and generates carbonic acid gas by the action of dilute acids supplied by tubes from the deck above. The gas finds its exit by numerous holes bored in the upper part of the barrel. The inventor of this brilliant process invited to his establishment at Woolloomoolloo, Sydney, a number of gentlemen, members of the legislature, &c., to witness the success of his patent, but the result was in keeping with the former details. His apparatus for confining the combustion to a closed space was so clumsily constructed that sufficient air found access to keep up the combustion in spite of the supply of choke-damp generated from whiting spread on "iron plates," not from a barrel.

It is sincerely to be hoped that we are not to be prohibited by letters patent from employing carbonic acid gas, generated in any off-hand apparatus, to extinguish combustion. This patent seems about as novel as the caustic soda process of Mr. J. Roddy, mentioned in the last volume of the Chemical News.

I am, &c. T. B.

Manchester, April 26.

Department of Seience and Art.

To the Editor of the Chemical News.

Sir,—As you have occasionally admitted into your columns strictures upon the operations of the Department of Science and Art, attacking now its supposed procrastination, now its inconsistency, and now its impolicy, allow me to submit to you the accompanying extract from a printed notice, which will show, at least, the generous intentions and liberality of the Council on Education towards its certificated science teachers, and which will, I hope, prove their sincere wish to foster the spread of an intelligent scientific taste among the people. It will also furnish some reply to those who have lately questioned the justice or desirability of retaining a special class of beneficed teachers; for it is obvious that were there no limitation to the number of claimants, such a bounty as that which the Government here offer—viz., of paying the expenses of each certificated master who shall visit the Paris Exhibition—would become impracticable. I believe a score of other good reasons could be given why teachers should conform to rule and submit themselves to examination before benefiting from the national grant; and so far from advocating the abolition of such tests, I, in common with many others, would rejoice to see the already high standard of qualification raised, as it is quite possible that the Department may design—it is time to grumble after we have seen their next May's questions—but I feel that it is absurd to expect the Department to continue to apply their vast machinery to the examination of sometimes a solitary candidate, as was my own case on a certain day last November. I am not surprised that they should meditate making the season of examination of both masters and pupils identical. That the questions proposed to each will be identical is now at least problematical; but were they the same it cannot be supposed but that such an experienced professor as Dr. Hofmann (even with his 1500 candidates) could perfectly discriminate by a series of judicious questions between the proficiency fitting for a teacher and that to be expected from a student; while the grouping together of both classes of men in the same grades, though it may mortify the vanity of incompetent or idle would-be lecturers, is at the same time an additional spur to such as have the pride to excel, from the fear lest distinguished pupils of other schools should be classified as their equals. I beg to subscribe myself as one who, though previously qualified to claim receipt of grants on result, yet preferred to submit to routine and become, after examination, A Certificated Master.

April 26.

"Their Lordships announce to the certificated masters now engaged in giving instruction in schools of science and art connected with the Department, that they will pay to each such master or mistress visiting the Paris Exhibition, the sum of five pounds in aid of their expenses, and to each an additional sum of two pounds for any report or any useful suggestions which any such teacher may make (in respect to his or her duties or teaching) derived from the study of the Exhibition, such report having first been published in any journal, local or otherwise, and afterwards approved by their Lordships. And further, to each of the three best of such reports referring to instruction in science and to each of the three best reports referring to art, my Lords will give respectively the following prizes in addition to the sum above named, namely—for science, for the best report, twenty pounds; for the second best report, fifteen pounds; and for the third best report ten pounds, and the same sums respectively to the three best reports for art."

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Alcohols, Synthesis of (C=12).—A Lieben. It appeared probable that the action of zincic compounds of alcohol radicals on chlorinetted ethers would be limited to the chlorine atoms, and afford the means of passing from one step in the series of alcohols to another. It was necessary, in the first place, to establish the constitution of chlorinetted ethylic ether. It appears that this is best expressed by

$$\left.\begin{matrix} C_2H_3Cl_2 \\ C_2H_5 \end{matrix}\right\} O.$$

By this light the body described by Lieben and Bauer as resulting from the action of zincic ethide on chlorinetted ether has the constitution expressed by

$$\left.\begin{matrix} C_2H_3ClC_2H_5 \\ C_2H_5 \end{matrix}\right\} O,$$

and should be called ethylochlorether. This body, under the action of iodhydric acid, gives ethylic iodide, ethylated ethylic chloride, and ethylated ethylic iodide, which last-mentioned body has the composition and boiling-point of Wurtz's butylic iodide. With argentic acetate it gives ethylated ethylic acetate and butylene, or a remarkably similar isomer of butylene. Ethylated ethylic acetate, when boiled with concentrated potash solution, gives ethylated ethylic alcohol, which is most probably isomeric with normal butylic alcohol, and identical with butylenic hydrate. If it be so, then Kolbe's conjecture that the ——enic hydrates are secondary alcohols is established.

Viewed from the same standpoint, another body which has also been described by Lieben and Bauer as a product of the action of zincic ethide on chlorinetted ether, wherein both chlorine atoms are replaced by ethyl, becomes diethylether,

$$\left.\begin{matrix} C_2H_3.C_2H_5.C_2H_5 \\ C_2H_5 \end{matrix}\right\} O.$$

Iodhydric acid produces, with it, ethylic iodide and diethylated ethylic iodide, and from this we may expect to obtain diethylated ethylic alcohol, a secondary or tertiary alcohol isomeric only with hexylic alcohol. It is easy to foresee the synthesis, on these principles, of an almost endless series of different alcohols.—(*Ann. Chem. Pharm.* cxli. 236.)

Mellitic Acid (C=12).—A. Baeyer gives, by letter, some results of researches undertaken in communion with Scheibler. Mellitic acid is hexabasic; it is benzol in which H_6 are replaced by $(CO_2H)_6$. Heated with lime, it splits into benzol and carbonic dioxide; sodium amalgam adds H_6 to it, with production of a hexabasic acid $C_6H_6(CO_2H)_6$, which is converted by sulphuric acid into a tetrabasic acid, $C_6H_2(CO_2H)_4$, to which body H_4 may be added, and carbonic dioxide again expelled by sulphuric acid, when benzoic acid is finally obtained. To complete the series beginning with $C_6(CO_2H)_6$, and ending with $C_6H_5(CO_2H)$, three members of which have been studied, and to extend the researches on the group beginning with $C_6H_6(CO_2H)_6$, more material is required than the authors can command; they therefore entreat possessors of the rare honeystone to come to their assistance.—(*Ann. Chem. Pharm.* cxli. 271.)

Dinitronaphthalene and Potassic Cyanide. (C=12).—Mühlhäuser. The reactions of potassic cyanide with nitro-compounds having been chiefly studied in the acid representatives of this group of bodies, it seemed necessary to extend the research in other directions, and dinitronaphthalene was chosen as a substance easy to prepare and purify. Pfaundler and Oppenheim, in 1865, made some experiments on the subject, but did not succeed in obtaining decisive results. An alcoholic solution of dinitronaphthalene is mixed with aqueous potassic cyanide solution, reaction occurs in the cold but is advantageously assisted after a short time by gradual heating to boiling. A fine blue-green colour marks the end of the reaction. On standing, the solution deposits the potassic salt of naphtocyamic acid $C_{28}H_{19}KN_8O_{10}$, easily soluble in hot water and in alcohol with a splendid blue colour. Its tinctorial power is very great; it explodes if heated; the baric salt is insoluble in cold water and in ether, easily soluble in hot alcohol; the argentic salt is almost insoluble in hot alcohol or water, and is very explosive. The free acid is uncrystallisable, insoluble in water, dissolving with brownish-yellow colour in alcohol or in a mixture of alcohol and water; it is bibasic. The acid and its salts are scarcely less sensitive to alkalies and acids than cyanin or irisine, for if water be shaken with magnesia, filtered, and mixed with a solution of the acid, the yellowish colour of the latter is immediately changed to bright blue.—(*Ann. Chem. Pharm.* cxli. 214.)

Ethylic Sulphate, Action of Ethylic Iodide and Zinc on (Ba=137, C=12).—A. Claus. Perfectly dry ethylic sulphate was digested with excess of ethylic iodide and granulated zinc; the reaction was fully accomplished at the ordinary temperature. The product is a solid dark-green, resinoid, semi-fusible mass. Water and ether were very gradually added to the contents of the flask until the violent reaction ceased; the ethereal solution, having been separated from the aqueous one, was distilled until the temperature rose above 100°; the retort then contained an oily liquid, in bulk about two-thirds of the ethylic sulphate employed, which, when further heated, began to evolve sulphuric dioxide. When all liquid had passed over, a loss of a quarter had occurred. This experiment was not, therefore, repeated, but the oil was boiled with successive small portions of baric hydrated oxide and water; the solution was saturated with carbonic acid, filtered, and evaporated; finally, crystals of $Ba.C_4H_{10}S_2O_4$ baric ethylsulphite were obtained. No other product of the principal reaction is described, but the fact that the addition of water in the first instance caused a copious deposit of zincic hydrated oxide suggests the formation of an intermediate zincic compound analogous to those obtained by Frankland and Duppa under corresponding conditions.—(*Ann. Chem. Pharm.* cxli. 228.)

Nicotine (C=12).—Dr. C. Huber. When treated with chromic acid, nicotine gives an acid $C_6H_5NO_2$, yielding easily crystallisable salts and azo-compounds. Distillation with lime produces C_5H_5N, an oily base soluble in water. The first reaction also produces another acid richer in carbon, and at least one base. Details will be given at a future time.—(*Ann. Chem. Pharm.* cxli. 271.)

Styrol, Isomeric States of.—M. Berthelot. Styrol from storax possesses a rotatory power on polarised light. That from cinnamates has none. The former is more easily attacked by reagents, and, when mixed with sulphuric acid, disengages more heat than the latter. Polymers of styrol produced by the action of heat or of potassium reproduce at 300° the original styrol, whilst those produced by the action of sulphuric acid distil in part undecomposed, behaving, indeed, as mixtures of distyrol, volatile at about 300°, and more highly condensed and less volatile polymers.—(*Bull. Soc. Chim. Paris*, 1867, 112.)

Coal-tar, Synthetical and Analytical Studies on.—M. Berthelot. The reactions of benzol and ethylene at elevated temperatures give rise to styrol, naphthalene, anthracene, chrysene, and some other constituents of coal-tar, the parent substances being themselves directly derivable from acetylene. Another group of constituents—the benzol series—might be expected to result from the action of formene on benzol; but reaction occurs only at a temperature incompatible with the existence of toluol, and anthracene is produced—a fact not without interest, since toluol is converted by heat into anthracene. Free formene differs therefore from free ethylene in its behaviour with benzol at high temperature. To obtain formene and benzol in presence of each other and nascent, a mixture of sodic acetate and benzoate was heated. A small quantity of toluol and a mixture of probably higher benzol homologues were obtained. The synthesis of toluol involves that of toluidine and of numerous other coloured coal-tar derivatives. The group of constituents which may be represented by aniline was studied in that member. A mixture of benzol and ammonia passed through a red-hot tube produced small, but unmistakable proportions of aniline. The oxygenated bodies—phenol, &c.—will be commented on at a future time. With respect to the analysis of coal-tar, cumol at a red heat gives rise to precisely the same series of hydrocarbons as contained in that complex mixture.—(*Bull. Soc. Chim. Paris*, 1867, 113.)

Thermo-chemical Conditions of Pyrogenic Reactions.—M. Berthelot. Ethylene combines readily at a high temperature with hydrogen and benzol, acetylene heated with many hydrocarbons combines with them freely; formene, water, carbonic dioxide, heated with hydrocarbons, either do not combine with them, or do so at a very high temperature only. The reason of this difference appears to be that the formation of ethylene and of acetylene is attended by a very slight evolution or even by an absorption of heat; the compounds when formed retain much energy, resembling in some degree simple bodies, and in their combination with other bodies positive work is performed with disengagement of heat; the formation of formene, water, carbonic dioxide, and ammonia is effected with great disengagement of heat, and their combination with hydrocarbons with elimination of hydrogen, if occurring at all, will be accomplished with difficulty from the negative work of the direct affinities, and the

absorption of heat attending the elimination of hydrogen; therefore in these cases it is necessary to call in the aid of bodies possessed of powerful affinities to supplement the negative work, and to perform the reactions by some indirect methods.—(*Bull. Soc. Chim. Paris*, 1867, 122.)

MISCELLANEOUS.

Scientific Lecturing pays well in America. Professor Agassiz lately delivered a course of lectures under the auspices of the New York Association for the Advancement of Science on the Natural History of Brazil, for which he demanded and was paid 500 dollars each, or 3000 dollars for the course of six lectures. Taking the time he devoted to each lecture—that is to say, an average of one hour and forty minutes—it thus appears that he received five dollars a minute for every minute he spoke. It appears, however, that the association which engaged his services did not lose.—*Pall Mall Gazette.*

Extraction of Indium from the Products of the Roasting of Blende.—The flue dust which condenses in the chimneys of the zinc works of Gosler contain indium. The author has operated on 100 kilogrammes of this dust, which contains about one part of oxide of indium in 1000. To extract this metal, boil the deposit for half an hour with hydrochloric acid, and digest the clear liquid with pieces of zinc for six hours at the ordinary temperature. There is then deposited a black metallic powder, which is washed with water, and which contains copper, arsenic, cadmium, thallium, and indium. By boiling this with a concentrated solution of oxalic acid, a solution of cadmium, thallium, and indium is obtained; the latter is precipitated by ammonia, and the precipitate is then boiled with ammonia and afterwards with water, until the washings contain no more thallium. The oxide of indium is then almost pure, and only contains traces of iron, from which it may be freed by Dr. Winckler's method given in the Chemical News, vol. xiv. p. 157.—*M. Boettger*, in the *Journal für praktische Chemie*, t. xcviii. p. 26, No. 9.

Determination of Iodine by Means of Chloride of Silver.—To determine the iodine contained in organic hydriodates, M. Kraut digests the solution for several minutes with a known quantity of recently precipitated chloride of silver; the increase of the weight of the chloride of silver is in proportion to the amount of iodine. This method has the advantage of not altering the substance beyond the removal of its iodine, which is replaced by chlorine. The process is very useful in many cases.—*Zeitschrift für analytische Chemie*, iv. 167.

Meetings for the Week.

Monday, May 6.

Royal Institution, 2 p.m. General Monthly Meeting.

Tuesday, May 7.

Royal Institution, 3 p.m. Professor Blackie "*On Plato.*"

Pathological Society, 8 p.m.

Geologists' Association, 8 p.m.

Wednesday, May 8.

Geological Society, 8 p.m. Dr. J. W. Dawson "*On a New Specimen of Eozoon*," with an introduction by Sir W. E. Logan. W. Whitaker, Esq., "*On Subaërial Denudation, and on Cliffs and Escarpments of the Chalk and Tertiaries.*"

Society of Arts, 8 p.m.

Microscopical Society, 8 p.m.

Thursday, May 9.

Royal Institution, 3 p.m. Professor Huxley "*On Ethnology.*"

Royal Society, 8½ p.m.

Friday, May 10.

Royal Institution, 8 p.m. Professor Bain "*On Correlation of Force.*"

Saturday, May 11.

Royal Institution, 3 p.m. Professor Huxley "*On Ethnology.*"

NOTES AND QUERIES.

Transformation of Naphthalin into Benzoic Acid.—Sir,—Can you inform me where I can obtain a formula for this process, mentioned in your number, 385, page 197, in Notes on the Paris Exhibition?—Sydney Hall. Swansea.

Nitro-benzol.—Sir,—Can you tell me how nitro-benzol can be obtained colourless and free from the tarry smell which usually accompanies it?—A Manufacturer.

Depositing Platinum Electrolytically.—Sir,—Will any of your correspondents tell me what is the best solution and battery power to be used for depositing a coherent film of platinum on brass? I should like it to be strong enough to resist liquid acids, but if this is impracticable, a resistance to acid vapours will suffice.

Chinese Blue.—Sir,—A friend of mine is desirous of obtaining a good receipt for making Chinese blue. He is a large consumer, and wishes to manufacture for himself and another house. He has made it, but not satisfactory in comparison with London manufacturers. He would of course pay handsomely for it. Would it be possible to obtain this? and through what channel?—R. H. W. Manchester.

Purified Shellac.—Sir,—In reference to the suggestion in your last number, I am the inventor of a new method of bleaching and purifying shellac, not by chlorine or its homologues, or by any injurious agent; it is in a state of solution in methylated spirits, and is applicable to gilt work, &c., not injuring anything it is applied to. To any one with a small capital, or in the above way of business, my services would be of value. I am not a thorough chemist, but possess a slight knowledge sufficient for the above. I cannot afford to advertise much, and think this would come under the head "Notes and Queries."—E. M. Nash.

Caramel Colours.—Sir,—Can any of your numerous readers tell me the best way to make these? I am a vinegar manufacturer, and use a considerable quantity for giving a dark colour to the vinegar. The manufacture is kept a profound secret by those few houses who make a speciality of it. I have made several attempts, but have hitherto been unsuccessful.—E. A. Glasgow.

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

F. W.—Declined with thanks. Your discovery possesses no novelty.

J. Glen and *A Constant Subscriber.*—In our next.

D. H. W.—M. Stas's researches have appeared in the *Proceedings of the Royal Academy of Belgium.* Inquire at Asher's.

G. M. E., Brighton.—The instrument is not yet complete. A full description will appear in the Chemical News as soon as it is in operation.

H. P. Meaden, Haslingden.—A letter is waiting for this gentleman at our office. If he will send his present address, it shall be forwarded to him.

M. Mond's Process for the Recovery of Sulphur from Alkali Waste.—The inventor has drawn our attention to the description of this process given by our Paris correspondent in our number for April 12, p. 181, as not being sufficiently clear. After saying that the process consists in forcing a current of air into the waste in order to oxidise it, and then lixiviating, the description should continue, "The solution is then drawn off, and air again forced into the waste, the mass again lixiviated, and the same treatment repeated a third time. The vats are so arranged that the liquor is allowed to run from one vat into the other in order to obtain it as concentrated as possible. The whole of these operations can be performed in from sixty to seventy-two hours." In the subsequent description, hyposulphite of lime should have been spoken of, instead of hyposulphite of soda. M. Mond says that the process is being successfully employed at many alkali works in England, amongst others at Messrs. Hutchinson and Co.'s, Widnes.

Communications have been received from Pritchard, Burden, and Co.; S. Hall; Rev. B. W. Gibson; T. Davies; P. M. Sargeant; J. Pratt; J. Tomlinson; M. Burton; H. Gillman; J. Hargreaves; J. W. Swindells; W. T. Suffolk; W. M. Bywater; Lloyd Smith; George Dutton (with enclosure); H. B. Condy; John Hull; Charles A. Wright; T. B.; Wotherspoon and Co.; G. M. E.; Sir W. Thompson (with enclosure); Geological Society (with enclosure); Dr. H. W.; F. Webb; G. Penney; Dr. S. Muspratt (with enclosure); R. H. W.; Sir H. J. Brownrigg; The Quekett Microscopical Club (with enclosure); J. Glen; A Constant Subscriber; G. A. Keyworth; L. Mond.

Books Received.—"Chemical Notes for the Lecture Room," by D. Wood, F.C.S.; "The Poisons of the Spreading Diseases," by B. W. Richardson, M.A., &c.

THE USE AND ABUSE OF BLACKBALLING.

We feel constrained again to draw attention to certain unprecedented proceedings which have distinguished the last two meetings of the Chemical Society. For some years the laxity of Fellows in exercising their right of blackballing candidates for Fellowship whose claims were clearly inadequate to entitle them to that honour has been a subject of general comment. Owing to the exceptional position held by the editor of this paper as journalist, and at the same time as a Fellow of the Chemical and other learned bodies, a friendly correspondence with many chemists in all parts of the country has been carried on at one time or another on matters connected with their Society. We are thus necessarily in a favourable position for ascertaining the existence of any grievance among the members.

The Council, as announced by the President at the anniversary meeting, finding that a wide-spread feeling of dissatisfaction existed at the undue facility with which anybody could join the Society, and that this privilege had been on more than one occasion seriously perverted for trade purposes, have lately had under discussion the best method of diminishing this abuse, and restoring to the title F.C.S. its former honourable distinction.

The subject of raising the qualification or restricting the admissions is beset with many difficulties; but those of our readers who are Fellows of the Chemical Society may rest assured that this question is receiving, and will continue to receive, the very serious attention of the Council. When the time comes for a proposal to alter the by-laws at a general meeting, we are convinced that the explanations and the reasons for such alterations, which will then be brought forward, will be adopted by a large majority.

The fact, then, is, that candidates have been admitted too freely. Country members complain that their brother members in London never exercise the right to blackball a candidate. It seems strange that attention should now have to be called to the fact that this undoubted right, so long in abeyance, is now apparently abused in a manner so reckless and suicidal as to seriously imperil the interests of the Society.

A few weeks ago we alluded to the abortive attempt on the part of a few junior members to rearrange the list of Council and officers. Failing signally in that endeavour, it would seem as if they were now attempting, by a concerted plan of action, to assume the governing power in the Society by blackballing candidates irrespective of scientific position or attainments. Thus, party interests are made secondary to scientific progress, and the healthy existence of the Society is imperilled for the gratification of private pique.

Of the five hundred Fellows of which the Society consists, seldom more than forty regularly attend the meetings, and of these the majority have hitherto abstained from balloting. According to the by-laws, "when less than three-fourths of the Fellows who vote are in favour of the candidate, he shall not be elected a Fellow;" supposing then that forty-seven voters are present, it will be seen that a dozen disaffected members are able practically to control the ballot box. Fellows should remember that the possession of a legal right to blackball a candidate, does not imply a moral right to abuse this privilege. They hold this in trust, to be exercised honestly for the good of the Society. In the "obligation" which each Fellow signs on his admission, he engages "to promote the interests and welfare of the Chemical Society," and he is not justified in recording an adverse vote simply to gratify the pitiful ambition of a small party, or to exercise a paltry spite against those who have won the confidence and support of the majority of members.

Between those elected and those rejected at the last meeting we wish to make no invidious comparisons. Few will dispute the qualifications of the fortunate candidates, but those rejected, from their position and scientific acquirements, may be fairly said to possess a very good claim to the coveted honour. In the absence of definite acquaintance with the qualifications of any candidate, the Fellows are, in a certain sense, morally obliged to vote for any one who has so excellent an array of recommenders from personal knowledge as could be seen on the certificates of the gentlemen who had to suffer, for no fault of their own, the indignity of rejection.

Before it is too late, we wish to appeal to the good sense of those who think themselves aggrieved. If they conscientiously object to a candidate, no one would ask them to violate their convictions by voting in his favour; but if they have any grievance, or wish to propose any alteration in the method of conducting business, let them adopt a straightforward course. We can promise them a patient and attentive consideration of any measure they may wish to introduce; but it is unbearable that ten or a dozen young men should, by devious strategy, attempt to overrule the wishes of the Council and of the great body of members.

Apart from the bad policy of making themselves personally obnoxious to the leading men of their science, the malcontents should consider that they are powerless permanently to control the elections; they could but snatch a momentary triumph, for immediately after the necesssary alteration of the by-laws the rejected candidates, if they still cared for the honour, would come forward with a fair prospect of election. A slight modification in the by-laws for the election of Fellows, which would certainly be approved at a general meeting if brought forward by the Council, would take from any clique a power which may be so unwisely wielded. The problem to be solved is how to guard against the admission of unfit persons into the Society, and at the same time to prevent voting by ballot becoming an organ for the gratification of private pique. In several ways the necessary alteration could be made, but we hope such a step will not be forced upon the Council.

London University.—Professor Williamson, Ph.D., F.R.S., and H. Debus, Esq., Ph.D., F.R.S., have been re-elected Examiners in Chemistry for the University of London. The salary of each office is 175*l.* per annum.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Classification of Native Silicates, by* William Odling, *M.B., F.R.S.*

(*Continued from page* 165.)

Again, the function of aluminium or alumina, in some particular silicate, is occasionally open to considerable question. Aluminium salts, it is well known, are derivable from acids, either by the substitution of an atom of aluminium, Al‴, for three atoms of hydrogen, as in ordinary alum $Al'''KS_2O_8.6Aq$; or by the substitution of an atom of aluminyl $(AlO)'$ for one atom of hydrogen, as in ordinary acetate of aluminium (the soluble diacetate of Crum) $C_2(AlO)'H_3O_2.2Aq$, or $Al'''O''(C_2H_3O_2)'.2Aq$. In the majority of aluminium-silicates, the aluminium would seem to play the same part that it does in ordinary alum, while in others it may not improbably function as aluminyl. Thus by viewing cyanite and topaz as aluminylic silicates, their anomalous formula $Al_2O_3.SiO_2$, would become reducible to the metasilicate type, and appear as

$$(AlO)_2O.SiO_2, \text{ or } (AlO)_2SiO_3;$$

while euclase would become an orthosilicate, thus—

$$(AlO)_2G_3O_4.Si_2O_4, \text{ or } (AlO)_2H_2G_2O_4.Si_2O_4.$$

But aluminium is not only capable of acting in two distinct fashions as a base, but it can also play the part of an anhydride corresponding to silica. Spinelle, $MgO.Al_2O_3$, and augite, $MgO.SiO_2$, for instance, may be regarded as analogous, though heteromorphous compounds; and it has been contended by Bonsdorff and others, with considerable show of reason, that in the aluminous augites and hornblendes, the alumina does not act as a base to the silica, but is substituted for a variable amount of the silica isomorphously. Similar remarks apply to boric oxide, B_2O_3, which, in some silicates, as axinite, appears to replace a variable but small proportion of basic alumina or aluminyl, while in others, it obviously fulfils the functions of an anhydride, as in datolite and botryolite.

$$Ca''_2H_2\begin{Bmatrix}B_2O_4\\Si_2O_6\end{Bmatrix} \qquad Ca''_2H_2\begin{Bmatrix}B_2H_2O_5\\Si_2O_6\end{Bmatrix}$$

In the great majority of well-defined aluminous double silicates, the ratio of monad and diad to triad or pseudo-triad metal is either the spinelle ratio

$$M''O \text{ to } Al_2O_3,$$

or else the cryolite ratio

$$M''_2O_3 \text{ to } Al_2O_3,$$

as exemplified below:—

Spinelle Silicates.

Ortho.	$CaAl_2O_4.Si_2O_4$	Anorthite. Wernerite.
1/1	$CaAl_2O_4.Si_2O_4.2Aq$	Thomsonite.
	$CaAl_2O_4.Si_2O_4.4Aq$	Gismondine.
Para.	$CaAl_2O_4.Si_3O_6$	Labradore.
2/3	$Na_2Al_2O_4.Si_3O_6.2Aq$	Mesotype.
	$CaAl_2O_4.Si_3O_6.3Aq$	Scolezite. Mesolite.
	$CaAl_2O_4.Si_3O_6.4Aq$	Zeagonite.
Meta.	$K_2Al_2O_4.Si_4O_8$	Leucite.
1/2	$Na_2Al_2O_4.Si_4O_8.2Aq$	Analcime.
	$CaAl_2O_4.Si_4O_8.3Aq$	Leonhardite.
	$CaAl_2O_4.Si_4O_8.4Aq$	Laumonite.
	$Na_2Al_2O_4.Si_4O_8.5Aq$	Phillipsite.
	$CaAl_2O_4.Si_4O_8.6Aq$	Chabasite.
Sesqui.	$K_2Al_2O_4.Si_6O_{12}$	Felspar. Orthoclase.
1/3	$Na_2Al_2O_4.Si_6O_{12}$	Albite.
	$CaAl_2O_4.Si_6O_{12}.3Aq$	Parastilbite.
	$CaAl_2O_4.Si_6O_{12}.5Aq$	Epistilbite. Heulandite.
	$CaAl_2O_4.Si_6O_{12}.6Aq$	Stilbite. Desmine.

* Dr Odling has kindly given us permission to publish occasional chapters from the forthcoming second part of his "Manual of Chemistry."—Ed. C. N.

Cryolite Silicates.

Basic.	$Ca_3Al_2O_6.Si_2O_4$	Gehlenite.
3/2	$Fe_3Al_2O_6.Si_2O_4$	Aphrosiderite.
	$G_3Al_2O_6.Si_2O_4$	Euclase.
Ortho.	$Ca_3Al_2O_6.Si_3O_6$	Garnet. Idocrase.
1/1	$Mg_3Al_2O_6.Si_3O_6$	Allanite. Orthite.
	$(NaCa)_3Al_2O_6.Si_3O_6$	Sarcolite.
	$(HCa)_3Al_2O_6.Si_3O_6$	Prehnite.
Para.	$Mg_3Al_2O_6.Si_4O_8$	Mica?
Meta.	$G_3Al_2O_6.Si_6O_{12}$	Beryl.

Other ratios are, however, occasionally met with, as in the following examples, and particularly the mixed ratio $MO + M_3O_3$ to $2Al_2O_3$, and the double ratio $2M_3O_3$ to Al_2O_3:—

Para.	$K_2Al_6O_{10}.Si_6O_{12}$	Potash-mica.
,,	$Mg_4Al_4O_{10}.Si_6O_{12}$	Magnesia-micas.
,,	$K_2Mg_3Al_4O_{10}.Si_6O_{12}$	
	$(LiK)_2Mg_3Al_4O_{10}.Si_6O_{12}$	Lepidolite.
,,	$Ca_4(AlB)_4O_{10}.Si_6O_{12}$	Axinite.
,,	$Ca_6Al_2O_9.Si_6O_{12}$	Humboldtite.
Meta.	$H_{12}Al_2O_9.Si_9O_{18}$	Cimolite.
Ortho.	$Ca_6Al_8O_{18}.Si_9O_{18}$	Epidote.
Meta.	$Li_6Al_8O_{15}.Si_{15}O_{30}$	Spodumene Triphane.
Anhy.	$(LiNa)_6Al_8O_{15}.Si_{30}O_{60}$	Petalite.

(δ) Among so-called hydrated silicates, the determination of the function of the constituent hydrogen is often a matter of considerable difficulty. It is clear that this hydrogen sometimes exists in the form of water of constitution or crystallisation added to the proper silicate molecule, whereas in others it exists as basic hydrogen, forming an integral part of the silicate molecule; but the means for determining the particular cases in which it exists in the one state or the other, or in both states simultaneously, are usually very imperfect, and sometimes entirely wanting. Dioptase, for example, may either be considered as an orthosilicate of hydrogen and copper, $H_2Cu''SiO_4$, or else as a hydrated metasilicate of copper, $Cu''SiO_3.Aq$, and so in many other instances.

The isomorphism of basic hydrogen with certain basic metals, and more particularly with magnesium, though scarcely established beyond question, is warranted by many facts relating to hydrated silicates. Thus, in several definite silicates, while the proportion of constituent hydrogen is very variable in different specimens, yet, reckoning this hydrogen as basic water, the ratio of the oxygen of the united bases to the oxygen of the silica is almost constant, and identical with the ratio of some typical compound. A variety of talc, for instance, is sometimes represented by the anomalous formula—$Mg_6O_6.Si_7O_{14}.Aq$; but, bearing in mind the temperature required to render such talc anhydrous, it can scarcely be doubted that its proper formula is really

$$H_2Mg_6O_7.Si_7O_{14};$$

or, seeing that the proportion of hydrogen is variable in different specimens, $(HMg)O.SiO_2$.

Prehnite, again, is usually expressed by the formula $Ca_2Al_2O_3.Si_6O_{12}.Aq$; but, independently of the exceptional ratio of lime to alumina, and of base to silica shown by this formula, in reality the proportion of hydrogen or water in different specimens of prehnite varies very considerably. But reckoning the hydrogen or water as basic, the oxygen of the united bases is to the oxygen of the silica exactly in the ratio 1/1, and the oxygen of the triad to that of the joint diad and monad bases approximately in the ratio 1/1 also. Similarly, in the different varieties of mesotype, there often exists,

in addition to the water formulated as water of crystallisation, a variable small excess of water which contributes to furnish the full complement of base appertaining to the particular silicate.

(ε) It is well known that the production of crystals, either by way of fusion or solution, is much affected by the presence of different impurities, dissolved or suspended in the crystallising liquids; and that, as a rule, the finest crystals are obtained from impure liquids, and carry down with them a certain proportion of impurity. Now, native silicates have all the character of crystals formed from impure liquids, and undoubtedly do contain, in many instances, a greater or less amount of accidental impurity. Chabasite, for example, frequently contains an excess of uncombined silica, with which, indeed, it is isomorphous; while some crystals of augite are said to contain a small proportion of garnet; and similarly in several other cases. Moreover, it is not improbable that certain definite silicates may contain variable proportions of other silicates—that a spinelle-silicate, for instance, may contain some cryolite-silicate, and a metasilicate some sesqui-silicate — in a state of perfect homogeneity, and without affecting their special crystalline forms; just as the heteromorphous alloys, Sb_2Zn_3 and Sb_2Zn_2, may each contain a not inconsiderable proportion of the other, without prejudice to the distinctive character of their respective crystalline forms. Altogether, while the analysis of artificial compounds is habitually preceded by their elaborate purification, that of native silicates is performed at once upon compounds never free from more or less accidental impurity, which, occurring in an otherwise definite silicate, may interfere very seriously with the right interpretation of the results of its analysis.

(ζ) Lastly, considering the number of operations to be performed, and of precautions to be taken, in order to obtain an accurate estimation of some one constituent only of an ordinary silicate—such as the alumina, or magnesia, or soda—it is evident that the difficulty and complexity of the processes employed in the complete analysis of most native silicates must be considered as detracting somewhat from the absolute certainty of even the percentage results arrived at. To this consideration may be added the probability, insisted upon by Laurent, that the few tenths or even hundredths of water contained in many silicates, and frequently disregarded both in the statement of results and calculation of formulæ, may sometimes, at any rate, fulfil a very important function in the constitution of the several minerals, and permit the association of their respective formulæ with those of well-recognised typical compounds.

Bearing in mind, then, the many circumstances interfering with the accurate determination of their molecular composition, it would appear that the actual types of native silicates are much fewer and simpler than is generally supposed; and, that in the great majority of instances, where the chemical formula of a mineralogically well-defined silicate is deduced from the analyses of a considerable number of different specimens, the ratio of the oxygen of the alumina to the oxygen of the other bases will prove to be either the spinelle- or the cryolite-ratio, or occasionally that of some closely related compound; while the ratio of the oxygen of the silica to the oxygen of the united bases will prove to be that of an ortho-, para-, meta-, or sesqui-silicate; and that in the majority of instances, where these ratios are seemingly departed from to some extent, the departure will be found really due to a partial substitution of alumina for some stronger base on the one hand, or for some silica on the other; or to a non-recognition of some constituent water; or the presence of some accidental impurity or intermixture. Altogether it is evident that a considerable latitude must for the present be permitted in the assignment of formulæ to complex native silicates, and especially to those of which but a few specimens have been submitted to careful analysis.

On the Purification of Chloride of Ammonium by Volatilising it in a Vacuum, by Prof. J. S. Stas.

The following is the method employed for the volatilisation of sal ammoniac in a vacuum:—

Forty grammes of chloride of ammonium obtained by the direct combination of hydrochloric acid with the ammonia produced by the reduction of nitrite of potassium, were introduced into a glass tube, ninety-five centimetres long and three centimetres in diameter, closed at one end and open at the other. The chloride, first well dried, being placed at the closed end, I placed the tube in a horizontal position on the metallic support of a gas jet; I put the open end against another open tube of the same diameter, and placed over the junction a glass tube of ten centimetres diameter, which I fixed with a cement of gum lac, letting some of the cement run between the tube and the two juxtaposed portions. To the second tube there was joined a T-shaped tube, whose very short, almost capillary branch went to the branch of a steel tap in which I luted it hermetically with a resinous cement. The vertical branch of the T tube plunged into a test-tube containing mercury. Into the other branch of the tap I cemented a capillary tube in communication with a pneumatic machine capable of making a vacuum in the apparatus of 0·0005 m. To prevent the sal ammoniac, which, in a vacuum, condenses as an impalpable powder, from penetrating into the almost capillary tube and blocking it up, I filled the large tube, to which the T tube was joined, with a brush of fine platinum wires, preceded by a large quantity of calcined and still warm asbestos. Before commencing the sublimation of the sal ammoniac, I made sure that the apparatus kept a vacuum for twenty-four hours. I then proceeded to the volatilisation. For this purpose I heated directly in a gas flame the part of the tube containing the sal ammoniac, *taking the precaution of keeping the temperature as low as possible.* During the sublimation the mercury continually oscillated in the vertical branch of the T tube, and the chloride condensed partly as dust and partly as a thick colourless ring. After the tube was cool enough for all tension to be removed from the sal ammoniac, the mercury rose in the tube to the same level as before the operation—a proof that no gas was formed during the sublimation but what was condensed afterwards. I made a second and then a third volatilisation of the same sal ammoniac. During the two latter volatilisations I took care to keep the air-pump continually at work, so as to carry off any gas that might be produced.

After the tube was quite cold, the sal ammoniac, which was sublimed in a compact ring, detached itself noisily from the tube, becoming at the same time opaque instead of transparent and highly refracting, as it was whilst hot.

I determined separately, and as they came from the tube, the proportional ratio of the sal ammoniac in a compact mass and in impalpable dust. Both contained traces of sodium, which, however, could only be appre-

ciated by spectral analysis; they probably acquired this metal from the ordinary white glass tube, in which the triple volatilisation was performed.

TECHNICAL CHEMISTRY.

On the Waste of Materials in the Alkali Manufacture, by JAMES HARGREAVES.*

(*Concluded from page* 220.)

5. **By non-decomposition or imperfect decomposition of sulphate of soda.**—The loss from this cause varies considerably in different manufactories. In some the average quantity of sulphate, or its equivalent in sulphate with sulphide, &c., is as 5 of sulphate to every 100 parts of available alkali, which is equal to a loss of 2·19 parts for every 100 parts of sulphate made available. In others (where the works are too small to afford, or the managers are too "economical" to employ, scientific supervision) the loss not unfrequently averages 24 parts of sulphate to every 100 parts of available alkali, by which 9·22 parts of the sulphate remain unavailed for conversion into carbonate for every 100 utilised. The loss from this cause generally varies between these proportions, more frequently exceeding the latter than going below the former.

The sulphate may remain unaltered in consequence of deficiency of carbonaceous matter, too low temperature of the furnace, or insufficient or unskilful working; or the decomposition may have only proceeded so far as to produce sulphide of sodium, without reacting on the carbonate of lime used in mixing the charge. This is the result of either a deficient quantity of carbonate of lime or bad working in the furnace.

When the crude soda or "black ash" is exposed to too high a temperature, an allotropic modification of sulphide of sodium is formed. This modified sulphide does not react on the lime present in the charge, but remains unchanged, and the black ash, instead of a grey, is of a dull brick-red colour, and forms a blue solution with water. When chlorine is passed through a solution from this red ash to convert the sulphide into sulphate, there is only a small portion so converted; the rest of the sulphur from the sulphide is precipitated—not being soluble in the alkaline solution—and may be separated by filtration. By this it is obvious that there is no dependence to be placed on the use of chlorine to convert the whole of the sulphide into sulphate, when the black ash is "burnt," and the loss shown by analysis is less than the real loss.

6. **By oxidation of crude soda.**—There are some manufacturers who think nothing of allowing the black ash to be exposed for several days to the weather before being lixiviated. When the weather is dry no harm is done, but in wet weather the balls are moistened, and the sulphide of calcium is rapidly converted into sulphite, hyposulphite, and sulphate of lime, which, reacting on the carbonate of soda, forms the corresponding soda salts, while the lime is converted into carbonate. To avoid this, the black ash must be kept quite dry, and not kept too long a time, but it should have sufficient time to become quite cold.

This action is also frequently continued in the vats, which being filled too full with black ash, a great quantity is exposed to the air in a wet condition. Each vat should not be filled so full but that the whole of the black ash can be covered with water at once, and never allowed to be uncovered till the vat is spent and run off. The vat liquor contains more sulphate in proportion to the available alkali than is contained in the black ash as drawn from the furnace, in consequence of this oxidising action of the atmosphere. The loss of alkali from this cause is seldom less than 0·2 per cent. of the whole; but I have frequently seen black ash in which the parts most exposed to the weather have had more than one-third of the alkali reconverted into sulphate of soda.

7. **By inversion of the furnace reaction.**—When the water used in lixiviating the black ash is too hot, the furnace reaction is inverted, the sulphur combining with the sodium, and the oxygen and carbonic acid with the calcium—

$$NaOCO_2 + CaS = NaS + CaOCO_2.$$

This reaction takes place more rapidly in weak than in strong solutions, and is therefore more apt to occur where the water is run on the weak vat warm, than when it is warmed by steam in each vat separately, raising the temperature a little in each successive vat till it reaches the strongest one.

If the vats are not perfectly cleaned from the waste from former charges every time they are discharged and filled, the waste remaining, and which has been exposed to the atmosphere, becomes partially oxidised, reacts on the soda solution, and forms soda salts of the sulphur acids, and the whole of the soda thus combined is for all practical purposes lost.

8. **By imperfect lixiviation.**—If an insufficient quantity of water is run through the vats, or the water is too cold, or the vats are worked too rapidly, or the black ash is thrown into the vats in too large lumps, or is deficient in porosity, a considerable quantity of alkali is left in the waste, and thrown away with it.

This loss is greatly increased by having too small a space for lixiviating the black ash, which allows too short a time for extracting its soluble constituents, and necessitates the use of hot water, thereby offering the alternatives of sustaining loss by decomposition of carbonate of soda, or by leaving soda in the waste, or needing a great expense to concentrate the liquor; for if hot water is not used a much larger quantity of water is required to extract the alkali, and as the solution contains a smaller proportion of alkali, the use of a larger quantity of fuel is required to concentrate it. These evils are best overcome by having ample vat space.

The waste should not contain more than 0·1 per cent. of alkali, which is equal to about 0·45 per cent. of the whole alkali originally present in the black ash. But it not unfrequently amounts to ten or even fifteen times this amount where there is no proper supervision of the vats and analysis of the waste.

9. **By spilling, leakage, &c.**, in moving material from place to place. This is a mechanical rather than a chemical question, and how to prevent it is too obvious to require comment.

The foregoing shows that, without any alterations in the principle of Le Blanc's process, there is still a large margin for improvement in the details of the soda manufacture.

Appleton-in-Widnes.

* Communicated by the author.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, May 8, 1867.

THE learned societies of the Scientific Association of France held their annual public meeting at the Sorbonne, Wed-

nesday, Thursday, and Friday of Easter week. The meetings were not well attended, and the few subjects discussed were not very interesting; the attraction of the Exhibition threw them into the negative pole of sight-seeing or lecturing. The distribution of the prizes took place on Saturday, April 28, at noon. M. Blanchard, Professor of Natural History at the Museum of Natural History, and member of the Academy of Sciences, gave a good summary of the scientific works carried on in 1866—1867. His good nature and lively imagination were actually necessary to conceal or counteract a truly lamentable sterility of subjects. We must say, notwithstanding the rather timid protestation of the Minister of Public Instruction, that the sciences, mathematics, physics, geology, botany, and meteorology have lost in France much of their ground; our mathematicians, physicists, and naturalists have let themselves be outstripped by foreign *savants* on the field of pure science. The Prussian needle-gun and the Enfield rifle have taken the palm out of our hands; they have, we may say, silenced the fire of our rifles.

This is a sad statement, but, alas! too true. The Congress that we have above mentioned was only a gloomy shadow compared with a meeting of the British Association for the Advancement of Science.

Apropos of the ozone-generating machine experimented upon by Mr. Beanes at the last *soirée* of the Royal Society of London, let us humbly call to mind that we were the first to make known the nature and application of this mysterious agent. In 1845, on the first news of the curious observations of M. Schönbein, we proceeded to Basle, and visited the celebrated chemist and professor. He condescended to repeat before us his numerous experiments, and we wrote to the *Epoque* a letter inserted on December 31. The following very important passage occurs:—"It is necessary to return immediately to the ideas of Ampère, and consider the atoms of bodies as having two states—first, with the essential primitive electricity or in a nascent state; second, with their electricity more or less disseminated, or their atmosphere of electricity in a neutral state. The ozone of M. Schönbein is, in our eyes, only a molecule of oxygen in a nascent state, with only negative electricity in its atmosphere. I am, I think, able to rigorously prove and account for the wonderful properties of this agent that we cannot lay hold of, and of which so much has been said." We ask all the chemists in general of that time, and Dr. Thomas Andrews, of Belfast, in particular, whether at that period any one had so clearly defined the essential nature of ozone, so much talked about, written upon, and discussed without coming to a decided conclusion.

Two years afterwards, when uncertainty yet reigned in all minds, we inserted in the *Nouvelle Revue Encyclopédique* of M. Didot, in the number for July, 1847, the following more explicit lines:—"Sufficient attention has not been yet paid to the important fact that oxygen disengaged by plants is not in a neutral state. We are perfectly convinced that this nascent oxygen, without its positive atmosphere, is the ozone discovered by M. Schönbein, with an odour *sui generis*, and possessing, in the highest degree, all the properties of electro-negative substances. The bleaching of linen stuffs, ivory, wax, &c., in the open air, on grass, the formation of nitric acid and saltpetre, also many other phenomena, are only caused by the powerful action of oxygen in a nascent state, or with its negative electricity developed." From 1845 to 1867, thousands of contradictory opinions have been written on the subject of ozone, to return again to the idea that we so clearly pointed out. We have so often pleaded the cause and defended the interests of others, that we must be pardoned for establishing, once for all, and very humbly, our own claims.

The Society for the Encouragement of National Industry has decided that, during the whole time of the Exhibition, it will hold weekly meetings, not on Wednesdays, as on that day too many members of the Council will be elsewhere engaged, but on Friday, when one is in general more free from domestic or social engagements. The first of these meetings took place on May 3, under the presidency of M. Dumas, and the aspect of the hall, the tables covered with crystal and glass, gas burners, objects in aluminium, &c., show at once a successful departure from the habits of the Society. The correspondence was, as usual, opened by the two secretaries, but it contained nothing interesting. M. Tessié de Mothay, in his name and that of M. Maréchal, of Metz, read a description of the processes of phototype which have led them to the definitive solution of the great problem of the indefinite reproduction, with thick and indelible inks, of photographic images. M. Tessié regarded as antiquated the anterior essays with regard to M. Davanne, of whom we have already spoken. He need not then speak of the photographic processes of MM. Niépce de St. Victor, Lerebours, Lemercier, and Barreswill, long since practised by the eminent photographer, M. Lemercier. Meanwhile, M. Barreswill thought proper to call to mind this first solution, and even thought that he was able to add that he had given results almost identical with those of the new process. We venture to affirm the contrary, and we are sure we shall not be contradicted on this point by M. Lemercier, who is very glad to substitute the new process for his own, the success of which was uncertain. The employment of so large a quantity of ether rendered difficult and unhealthy the process, which had already given way to the incomplete method of M. Poitevin.

M. Dumas then gave the *parole* to M. Paul Bérard, who directs, with M. Paul Audouin, the Laboratory of Essay for the Illuminating Power of Gas, established in the Rue du Faubourg Poissonnière for the Municipal Administration of Paris, under the head direction of MM. Dumas and Regnault. The young chemist resumed, and confirmed by many experiments, results obtained, having a double view—1. Two flames of equal intensity being given, one produced by a carcel lamp burning under fixed conditions, the other by a gas burner, burning as much as possible under the same conditions, to determine the respective consumptions of oil and gas, in a given time, for each of the apparatus; 2. To study different burners, and the best conditions for the combustion of the gas.

The first problem was completely resolved by a series of photometric apparatus, very well constructed by M. Deleuil, and which comprise a carcel lamp burning at the normal rate of oil, a Foucault photometer with starched glass plates, and a telescope and movable plates, a standard burner and an argand one with 30 holes, and an automatic balance indicating by a scale, with the precision of 1 centigr. for a charge of 3 kilos., the quantity burned by a carcel lamp. M. Audouin said nothing of the photometric method; he did not even mention the name of M. Deleuil, but he enumerated very rapidly the conclusions of the experiments on burners. Let us mention them, as they are truly well defined. With *bat's-wing burners* the maximum of illuminating power corresponds to a slit $\frac{7}{10}$ths of a millimetre wide. The same quantity of gas can give, when it burns in a good burner, four times the light given by a bad one. The increase of illuminating power corresponds to a very rapid diminution of pressure, and consequently to the diminution of the velocity of flow; in other terms, with equal consumptions of gas of a constant composition, the greatest illuminating power corresponds to the lowest pressures, the maximum corresponding to a pressure of 2 to 3 millimetres. The proportion between the diameter of the nipple and the expenditure, keeping the same width of slit, $\frac{7}{10}$ths of a millimetre, has next to be determined. The gas flows with the same velocity or under the same given pressure, always with the same illuminating power, whatever be the bat's-wing in which it burns. For very different

intensities the dimensions of the flame vary very little, its height being sensibly constant and terminated by a right line. *Other burners than bat's-wings.* Bougie burner, a nipple with a hole in the centre. For the same height of flame, the illuminating power always coincides with weak pressures and a hole of $\frac{7}{10}$ths of a millimetre; it increases almost indefinitely with the height. The great expenditures of gas are more advantageous than the weak ones. Manchester burner, a nipple pierced with two holes. When the diameters of the holes are very small, two bougie burners give a light equal to that of a Manchester burner, which they can form by their union. But the superiority of the Manchester burner over the two bougie burners becomes more and more considerable according as the holes increase in diameter. The maximum lighting power corresponds always to the minimum pressure, and to a diameter of $\frac{7}{10}$ths of a millimetre. *Burners with a double current of air.* The argand burner of 30 holes, $\frac{7}{10}$ths of a millimetre, proved the most advantageous of all, and it is much to be regretted that it was not compared with the Monier burner, which is much more economical again. The lighting power increases indefinitely with the expenditure; the height of the chimney should not exceed 20 centimetres. The quantity of air burned by a burner is not proportional to the consumption of gas; all the burners do not require the same amount of air in order to give the maximum of lighting power. The introduction into common gas of 6 or 7 per cent. of air diminishes its lighting power by a half. 20 parts of air mixed with 80 parts of gas gives no light.

The standard carcel lamp consumes 42 grammes of oil per hour. According to the treaty between the town of Paris and the General Gas Company, 25 litres or $27\frac{1}{2}$ litres of gas burned in a standard burner under a pressure of two or three millimetres should furnish a flame equal in intensity to that of a carcel lamp burning during the same time 10 grammes of purified colza oil.

M. Debray then resumed the history of the preparation, properties, and uses of aluminium discovered by M. Wöhler, and brought into use by M. Henri Sainte-Claire Deville. The principal progresses made in this industry are—Utilisation of bauxite, a clay very common in the South of France, composed nearly exclusively of alumina and sesquioxide of iron; to this is due the purity of the aluminium of commerce. The employment as flux of salt and cryolite (double fluorine of aluminium and sodium, very abundant in Greenland). This metal is used for optical instruments, and many other objects of jewellery, &c., and even for culinary purposes. Aluminium bronze, composed of copper 90 to 95, aluminium 5 to 10, is its principal use. M. Debray stated as extraordinary facts that this bronze, containing 95 per cent. of copper, was very little attacked by acids; also that chlorine was a deleterious gas, and sodium poisonous, but that chloride of sodium (table salt) was innocuous!

When M. Debray sat down, M. Dumas rose and indicated in a few words the aim of these weekly meetings. What characterises, he said, the Exhibition of 1867 is the enormous progress made in the application of the sciences to industry and fine arts; everywhere in these immense galleries we see the facts and theories of pure science become materialised into practical applications of great value. Is it not very natural, then, that the Society of Encouragement should become the revealer and appreciator of the successes obtained in what may be called its special department?

We are surprised that the illustrious President does not try some other thing than a reduced copy of our own programme in the conferences of the Exhibition 1867. He attempts to perform far from the galleries, in a very confined space, in presence of a very limited auditory, what we aspire to do in the midst of the Champ de Mars, in a great amphitheatre holding 500 auditors. How does it happen that the Commission of three members, the triumvirate, Dumas, Michel Chevalier, and Perdonnet, charged by the Imperial Commission with its organisation and direction, have not signified to us, by the intermediation of M. Perdonnet, their intentions issued as follows?—1. That the entries shall be gratuitous. 2. That none of the lectures shall be paid. 3. That no exhibitor shall be admitted, either by himself or by a third party, to exhibit or make known the progress he has accomplished. Is it not tyrannically unjust to make gratuitous a lecture-hall, constructed according to a very severe specification entailing an expense of 50,000 to 60,000 fr.? Is it not barbarous to prevent 100 or 200 fr. from being taken from the money received at the doors and given to the *savant* who may have succeeded in interesting a vast auditory, and initiated them agreeably and usefully into the nature and advantages of some novel branch of industry? St. Paul characterised this barbarism in remarkable terms in his Epistle to the Corinthians, when he told us not to muzzle the ox while eating.

Lastly, it is astounding that what is permitted, honourably, legally, and praiseworthily, under the patronage of the illustrious President of the Council of the Society of Encouragement, could at once become illicit and blamable in the eyes of the Imperial Commission, of which he forms part, even of the *triumvirate*. The letter of M. Perdonnet we keep with great care. The triumvirate is totally ignorant of the fact that the lecture-hall was mounted (it is very nearly finished) at private expense on the same terms as the other establishments of the Champ de Mars Park. A lecture-hall on the subjects of objects exhibited seems to us an indispensable adjunct; yet the Commission did not think it worth their while to build one; they gave the concession of ground to the celebrated photographer, M. Pierre Petit (who had already given 2800*l.* for the site for his pagoda), on condition that he would build a lecture-hall and furnish lectures, the profits of course to be his own. Not so. Right about face with the Commission. The lecture-hall being done, and the expense paid for, M. Petit is told that all his labour in that direction is in vain. The Commission should, at least, reimburse the sum he laid out in bricks and mortar to please the Imperial Commission. Do they want to rob him also? Every establishment for public amusement is there opened on the adjoining grounds, and they place *what price they like* for entrance; but intellectual and practical information, the food of the mind, seems to find no favour with the triumvirate. F. Moigno.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Long ago the researches of Messrs. Deville, Lechatelier and Kessler proved that fluosilicic acid, if it could be produced cheaply, would most advantageously replace sulphuric acid in the great industries of potash and soda. On the one hand, some facts seem to indicate that, under certain conditions, silica, melted with fluoride of lime at the highest temperature of our furnaces, produces fluoride of silicium and silicate of lime; on the other hand, celebrated German and English engineers affirmed that the furnaces for smelting copper with fluoride of calcium disengaged at the furnace mouth fluoride of silicium, which seems to indicate, conformably with the analyses of M. Berthier, that carbon played a great part in the production of fluoride of silicium by the dry way. Starting from these principles, M. Tessié de Mothay caused to be melted in a closed crucible a mixture of two equivalents of silica, three equivalents of fluoride of calcium, and four equivalents of carbon; and he proved that at the temperature of melting iron a great quantity of fluoride of silicium was evolved. The slag resulting from the calcination, when analysed, showed that the fluoride of calcium had lost 52 per cent. of its fluorine; and direct observation proved

that the fluoride of silicium produced was always accompanied by carbonic oxide gas. Convinced by these preliminary experiments of the possibility of the industrial production of fluoride of silicium, M. Tessié de Mothay made, along with M. Ede Kescher, of Sarrebruch, in a melting-pot of the works at Ars-sur-Moselle, a first essay at reduction. This was crowned with complete success, and they proceeded immediately to construct furnaces for the production on a great scale—first, of fluoride of silicium and fluosilicic acid; second, of caustic potash and carbonate of potash, extracted by the action of fluosilicic acid from the chloride of potassium of the Stasfurth mines. The quantity of fluosilicic acid obtained in the blast furnace of Grösbleterstroff, near Sarrequemines, is already sufficient to enable them in some months to deliver a ton of potash per diem at a cheap rate to the trade.

This process of fabrication is very efficacious and simple, since, by aid of fluosilicic acid, they collect 68 per cent. of the fluorine contained in the fluoride of lime. It consists in —1. Kneading, as in a brick-making machine, carbon with a mixture of silex, clay, and fluoride of lime, in quantities proportionately equivalent, and the formation, after fusion in the blast furnace, of a bibasic silicate of alumina and lime. 2. Mixing the cakes with the proportion of coke necessary for the fusion. 3. Filling all the furnaces through a double chamber to hinder the passage of the gases by the furnace mouth. 4. To melt the cakes by an intense heat produced by powerful blowers, and to collect the gases in condensers whose surfaces are continually wetted, so that the immediate contact of the water decomposes the fluoride of silicium into hydro-fluosilicic acid.

In Class 51 is exhibited a complete plan of the works and blast furnaces of Grösbleterstroff; and in Class 44 a series of bottles containing fluosilicic acid of 180°, fluosilicate of potash, of soda, and of barytes, caustic potash, and soda, which the fluosilicic acid has separated from their combinations with sulphuric acid.

Chemists, only a few years ago, would have refused to believe that one could procure so easily and certainly, and on so large a scale, a product hitherto confined to the laboratory, but now destined to modify in the most successful manner one of the most important of modern industries.

Paintings on glass required to be transparent must have a thickness of enamel four or five times greater than that of paintings on ceramic paste which are to be viewed by reflection. Hence it follows—1. That the designs made to be transferred to glass cannot be printed from ordinarily engraved copper plates, since, after baking, it would not have the necessary thickness and opacity; 2. That the organic matters serving as a vehicle for the vitreous flux to make the impressions must be increased in a quantity proportional to the amount of the enamels they are to contain.

In order to resolve the problem of impression by means of applied drawings of enamelled pictures vitrefiable on glass, it was necessary to have recourse to the employment of deeply engraved plates, similar to those for paper-hangings and stuffs, and organic inks containing the enamels in a state of combination.

But all the vehicles hitherto employed for printing enamels, porcelain, and earthenware, when mixed with colouring fluxes in sufficient proportion to permit of the impression, cause on the glass, during the baking, the deformation of the designs, and, in numerous places, non-adherence to the surfaces they cover. The same effects of deformation and non-adherence are equally produced with inks composed solely of resinous siccatives, essences, bitumens, resins, and other analogous vehicles.

MM. Tessié de Mothay and Maréchal have happily proved that the organic inks favour, on the contrary, the union of the vitreous flux with the sheets of glass; in fact, the solvent of the colouring matters used in painting on glass is in general silicate of potash and lead, or a silico-borate of the same bases. This combination, rendered plastic by the addition of more or less resin dissolved in the turpentine, is a perfect ink, which, printed in a thick layer and transferred to glass, is burnt and vitrefied without deformation or air-bubbles. Thanks to it, it is possible to employ, for the reproduction of ornamental or plain prints, the rollers, with deeply cut lines, which serve at Mulhouse for the printing of stuffs. Worked by steam power, these rollers produce in an hour more than 250 skilful designers could do in a day. Many thousands of plain patterns and mosaics of stained glass produced by this process already adorn our churches, and the low price at which they are produced and sold tends every day to multiply the number.

The same investigators have also discovered a new method applicable to the production of photographic images of all sorts on glass, enamel, lava, porcelain, earthenware, &c. It comprehends a series of ten operations, which we will summarily describe in their order:—1. Four parts of caoutchouc are dissolved in a hundred parts of benzol. To this solution is added one part of normal collodion. This compound is poured upon any of the substances on which a vitrefiable portrait is required to be produced. It is then dried, either in the open air or in a stove, until a very coherent coating is formed. 2. On this first coating, thus dried, iodised collodion is poured. This second coating unites intimately with the first, and thus acquires a resistance equal at least to a layer of caoutchouc of the same thickness, a resistance which no ordinary collodion possesses. 3. After having immersed the double coating, thus prepared, in a bath of nitrate of silver, an image is produced on it, either by a camera or by superposition. 4. The latent image thus produced is developed by any of the agents generally used. 5. It is then fixed by successive action of two baths, one containing a solution of an iodocyanide, and the other an alkaline cyanide. 6. The image thus fixed is steeped for some instants in a solution of sulphate of protoxide of iron, pyrogallic acid, or any other substance that will reduce the salts of silver. 7. The image is intensified by the action of pyrogallic acid, gallic acid, formic acid, or sulphate of protoxide of iron, mixed with an acid solution of nitrate of silver. This strengthening requires, on an average, four to six applications, when the image is to be seen by reflection, and twelve to fifteen for those which are to be seen by transparency. During this operation of reinforcement, the images are washed three or four times in alternate baths containing iodo-cyanides and alkaline cyanides, then, immediately afterwards, in sulphate of protoxide of iron, pyrogallic acid, or any other reducers of the salts of silver. The consecutive employment of baths of iodo-cyanides, and of alkaline cyanides, has the effect of completely dissolving the non-adherent silver precipitated over the whole plate in each reinforcing bath, and this without destroying the original image, which alone is intensified. The washings in the reducing bath rendering neutral the metallic surface, increase powerfully the ulterior action of the reinforcing baths. 8. The photographic image, being developed, fixed, and reinforced, is immersed for several hours, either in a bath of chloride or nitrate of platinum, or in alternate baths of chloride of gold and nitrate of platinum, or, again, in baths of chloride of gold. During the steeping, the silver of the image is either partly replaced by platinum, by a mixture of platinum and gold, or by gold alone. The purpose of the different substitutive baths is in order that the colour and nature of the layer of silver of the image may be changed after vitrification. In fact, if it is desired to obtain by the muffle, and by the reactions of silicic or boracic fluxes, images of a greenish black, they are previously immersed in a bath of chloride or nitrate of platinum; if, on the contrary, a black colour be required, they are steeped successively in baths of chloride of gold and nitrate of platinum. When, lastly, gilt images are to be produced, they are plunged into baths containing exclu-

sively salts of gold. 9. The image, on coming from the platinum or gold baths, is washed in a solution of alkaline cyanide or concentrated solution of ammonia; it is then covered with a thick varnish of caoutchouc, or with gutta percha, and submitted to the action of fire, in a muffle, when the organic matters are consumed and the metal left. 10. Lastly, the image, thus freed from the collodion and other organic matters, is covered with a silicic or boracic glaze, and submitted to an orange-red heat, which vitrefies it. This method is calculated to effect the perfect preservation of photographic images.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, May 2.

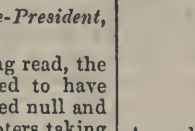
Professor W. A. Miller, *M.D., Tres.R.S., Vice-President, in the Chair.*

On the minutes of the previous meeting being read, the Chairman stated that the election announced to have taken place on the last occasion must be declared null and void, by reason of an insufficient number of voters taking part in the ballot. The name of another candidate who was then returned non-elected would also be again suspended, since the ballot in both instances was informal. The minutes were then confirmed. The following gentlemen then signed the statute book, and were admitted Fellows of the Society, viz., Messrs. Henry Weston Eve, C. R. A. Wright, William K. Waite, and J. W. Hudson, LL.D.

The candidates now proposed for election were Augustus Alfred Wood, 74, Cheapside; William Phipson Beale, barrister-at-law, Stone Buildings; and Alfred Coleman, Plough Court, Lombard Street. For the second time were read the names of Robert R. Tatlock, Millhouse, Kyles of Bute, and Walter William Fiddes, gas engineer, Sothernhaye, Clifton. For the third time were read the names of John Cargill Brough, 4, Norman Terrace, Stockwell; F. W. Peterson, of her Majesty's Mint, Calcutta, 51, Myddelton Square, London; and three other candidates. Before proceeding to the ballot, the Chairman said that the measure which had been under the consideration of the Council, and which was intended to raise the standard of qualification required for a member's admission into the Society, was not to be construed as being retrospective in its operation, and it would be manifestly inconvenient if the regulations were made more stringent in the case of the candidates proposed for election on this occasion. Upon the ballot being opened, the Fellows to the unusually large number of thirty-two recorded their votes, and the balls in certain instances had to be very carefully counted. The result was the return of Mr. Brough and Mr. Peterson as Fellows of the Society, but the other three candidates were declared non-elected.

The Chairman referred to the circumstance of so many of the leading members being in attendance at the Paris Exhibition and elsewhere, and said that a difficulty had been encountered in the attempt to provide formal matter in the shape of papers to be read; he would, therefore, invite communications from any Fellow or visitor in the room, who chanced to have any subject of interest in a sufficiently forward state to bring before the notice of the meeting.

Dr. Odling claimed the indulgence of the meeting in regard to the remarks he was about to offer, with a view of starting a subject for discussion. In the first place, he would mention, for the information of the manufacturing chemists, that the French had apparently succeeded in working out a great commercial problem with respect to the recovery of sulphur from the waste residues of the alkali manufacture. Great blocks of sulphur were shown in the Paris Exhibition which were said to have been prepared from this source, and it was proposed to employ it in making gunpowder and other sulphur products. So far as the speaker was aware, no published statement of the *modus operandi* had appeared, but it was generally believed that manganese in some form, and possibly the refuse of the chlorine retorts, was made available.* In the event of these anticipations being realised, there were vast accumulations of waste material in the north of England which could thus be economised. Turning to another topic of more abstract scientific interest, Dr. Odling observed that he found a difficulty in recognising the law of combination by saturation capacities, in what had been termed the "atomicity" of nitrogen. For instance, this element was found at one time entering into combination with *three* atoms of hydrogen, and thereby forming ammonia, whilst at other times, as in sal ammoniac, the nitrogen was united with *five* associated atoms. The constitution of these bodies might be thus represented:



According to this view, nitrogen had always five bonds, two of which, in the first example, controlled one another's activity, and all five were brought into play and united either with hydrogen or chlorine in the ammonia salt. In the union of chlorine and nitrogen, there must be an abstraction of heat, since the decomposition of the chloride of nitrogen was attended with the disengagement of a considerable amount of heat, yet, if chlorine be passed into ammonia, there was still a development of heat, and, nevertheless, the chlorine, we are told, leaves the hydrogen in order that it may unite with nitrogen, an element for which it has a very slight affinity. It might then, from this reaction, be doubted whether nitrogen was really pentatomic. Again, sodium exposed to air produces Na_2O, and this dissolved in water (with disengagement of heat) produced a hydrate, from which the water could not again be driven off by heat. But inasmuch as sodium gives out more heat than hydrogen by its union with oxygen, the conversion of the molecule of sodic oxide into hydrate would produce exactly as much cold as the conversion of the molecule of water into hydrate would produce heat. Thallium differed from sodium in these respects, and its hydrate lost water by the action of heat. These facts prove that sodium exerts upon the hydrogen an action which thallium does not. Other illustrations were quoted: thus in the slacking of lime there was great heat evolved, whereas the contrary result might have been expected, since there was, so to speak, "an unburning of the calcium." In the instances of barium and magnesium there seemed also something requiring explanation. The speaker concluded by offering an apology for having brought forward these considerations in an incomplete form, but he trusted that the attendant circumstances would justify his having taken such a step.

Professor Williamson remarked that chemists were very much in the habit of losing sight of one most important fact—viz., the changes of properties which elements undergo in combination. When they found that one element had got certain combining forces, they were apt to suppose that it must retain them when partially saturated by some other element. Thus, admitting that in potassic hydrate an atom of oxygen was combined, on the one hand, with an atom of potassium, on the other with an atom of hydrogen, it was not correct to assume that the force which bound it to the hydrogen was the same as that which bound it to each of the two atoms of hydrogen in water. The atom of oxygen in potassic hydrate was altered by its combination with potassium in such a way that it combined more powerfully

* It has been suggested that the sulphur may possibly have been extracted by the method of M. Emile Kopp described last year in the *Moniteur Scientifique*—Ed. *C. N.*

with hydrogen than in water. So also in sal ammoniac, an atom of nitrogen was united with five atoms, four of hydrogen and one of chlorine. By uniting with hydrogen it had become more basylous, and could hold chlorine more firmly than it could do when united only with chlorine. Professor Williamson added a few remarks on the subject of the word "atomicity." He was of opinion that all we know on the subject was represented by the word equivalence, and he recommended the retention of the word equivalence. "Atomicity" was used by some persons to denote an immutable equivalence, and in such sense was untrue and mischievous.

The Chairman entertained an objection to the use of the word "atomicity," since it implied a theory, whilst the term "equivalence" was merely a statement of the facts.

Dr. Thudichum said that in taking note of the fact that three successive speakers had expressed their dissatisfaction with the term "atomicity," he begged to state that he had never used it, but had from the beginning of his teaching described the property of atoms which it was intended thereby to signalise as "dynamicity." He recognised a priority of publication of the conception of the necessity for this change on the part of M. Würtz,† although this chemist had not made the change nor abandoned the questionable word. No one who valued logic could use expressions which signified the "indivisibleness of the indivisible," or the "undividedness of the undivided," with the effect of thereby defining anything; but the expression would appear still more illogical when it was considered that it was used to define a power the very essence of which, as it appeared from one point of view, was divisibility. Indeed, the expression "tomicity," if properly understood to refer to the power, and not to the matter or body of the atom, would be correct for a far greater number of cases than the same word with the privative "a" prefixed could ever reach. Those who had hitherto been most active in developing the theory of "atomicity" had implied that it was a power possessed by the atom absolutely, and that in cases where apparently only a portion of the maximum power which an atom could exercise was employed, the rest of its power was free, and open to engage itself. Late developments of science had, however, made it very doubtful whether this was a correct appreciation of the facts observed, and whether the changes in the amount of power exhibited by atoms were not actual changes of the amount of power possessed by them in concrete cases. Indeed, if he had rightly understood some theoretical considerations of Kolbe and of Würtz, these chemists seemed to admit that what they called "atomicity" was a changeable power of atoms, and that was the conclusion towards which his own studies and reflections had been driving him (Dr. Thudichum) for some time. The positive part of his opinion would appear from a few definitions which he begged leave to lay before the meeting. The idea of atom included, of course, that of element, in the chemical sense; and most chemists defined atom as the smallest quantity of an element that could exist in any chemical compound. All atoms manifested various qualities of power, and of some qualities of power many atoms manifested varying quantities. The first obvious power of atoms was that of polarity, the differentiation of which, in two opposite qualities (conveniently termed positive and negative, or + and −), explained the formation of the elementary molecule, or molecule consisting of two atoms homogeneous in every respect except that of polarity. Atoms further manifested chemism, or power to effect interchange of place, or substitution, or combination with heterogeneous atoms, polarity determining the place which each atom should take with reference to any other. Chemism is a stronger power than mere polarity; it separates the homogeneous molecule; but, in forming a new and heterogeneous molecule, it adds the entire amount of the polarity of the atoms employed to its own effective power. Thus, out of the combination of a molecule of hydrogen $\overset{+-}{(HH)}$ and a molecule of chlorine $\overset{+-}{(ClCl)}$, there result by the action of chemism two molecules of hydrochloric acid, equal in all respects except the polarity of their constituent atoms. The next quality which atoms manifested was dynamicity, which might be defined as the faculty to vary—that is, to decrease and increase—the amount of power of combination with other atoms. This power might be exercisable in multiple directions at the same time, but was not separable as to seat. For the intensity with which an atom was held, or exercised itself, in combination, dynamicity afforded as yet no measure. That intensity was no doubt the result of polarity, chemism, and dynamicity, and probably other influences, combined. But for the numeral quantity of power or the number of units of power of combination as measured by certain assumed standards, dynamicity afforded a correct expression. The unit or minimum of dynamis manifested by an atom, he termed monad; the greatest number of units constituted its monado-atomic equivalent, or full dynamis. The assumed standard of unit of dynamis hitherto accepted had been hydrogen, and the maximum number of units of power, or monads, hitherto attributed to any atom had been six, or once, in the case of iodine, seven. Now, the great error of the atomicity doctrine, most useful as it had been in evolving new facts and ideas, was this, that it assumed the number of monads of the atoms of each element to be invariable. The application of the doctrine of dynamicity to a broad field of chemical facts would, however, soon show that the dynamicity of atoms was variable, called forth or imparted by influences external to the atom, and similarly withdrawn. Heat, light, electricity, vital power, and pathogenetic power were such influences, governing not only the polarity and chemism, but also the dynamicity of atoms. Hydrogen manifested itself most commonly as monodynamic; it could be substituted by iodine and nitrogen. Now, iodine might be tridynamic, as in ICl_3; nitrogen might be tridynamic, as in ammonia. In the latter case the defenders of the invariable pentadynamicity of nitrogen would say that it was only active with three monads, and that two were free. In the case of iodine, however, when it substitutes hydrogen, the assumption that it only functioned with one monad out of its three was inconvenient, as it opened the door to the admission of the same variability on the part of hydrogen, and therefore iodine was here commonly admitted to be monodynamic. When nitrogen was made to substitute hydrogen, it lost apparently all dynamicity, though exercising only one, according to the assumption of the invariable monodynamic character of hydrogen. Out of such difficulties there were, no doubt, ingenious modes of extrication, such as the assumption of molecular powers on the part of combined groups of atoms not having the character of radicals. But the simplest cases were most simply explained by the hypothesis that the dynamicity of an atom was variable and dependent upon external influences calling forth its manifestation. Iodine had already been shown to be monodynamic and tridynamic; in imide, nitrogen was as monodynamic as when it substituted hydrogen in azobenzoic acid; in amide, nitrogen was didynamic; in ammonia the atom of nitrogen exhibited tridynamic combining powers; in some of the compounds lately discovered by Griess it showed tridynamic substitution power, replacing three atoms of hydrogen. The generalisation of this conception would no doubt destroy the simplicity of the present doctrines, but lead to a better appreciation of all the powers and influences determining combination or separation. In conclusion, the speaker apologised to the Society for the imperfection

† The reader is referred to the footnotes, p. 184 of Würtz's "Philos. Chimique." Paris. 1864.

of his remarks. They had been quite *impromptu*, and dealt with a great and difficult subject, which in many respects required consequential development. But he recommended his terminology‡ to the attention of the members, feeling sure that a slight familiarity with it would prove its great convenience.

Professor Foster agreed with Dr. Odling that, when the two molecules Na_2O and H_2O were converted into $_2NaHO$, the change undergone by one molecule was the converse of that undergone by the other, and, therefore, that it was difficult to understand that the quantity of heat developed in the one case should differ from that absorbed in the other; but he observed that there was no direct proof that the reaction in question was attended with any evolution of heat: when water acted on oxide of sodium, a great part of the observed evolution of heat was certainly due to the combination of NaHO with excess of water, and it remained to be proved that this action was not the source of the whole. The conversion of BaO and H_2O into BaH_2O_2 he regarded as a reaction not perfectly comparable with the above, since, in this case, the two molecules BaO and H_2O coalesced into the single molecule BaH_2O_2. With regard to the different behaviour of what appeared to be similarly constituted molecules when subjected to the same treatment, as, for example, that of sodic and thallic hydrates at high temperatures—an instance to which Dr. Odling had referred—he considered that the explanation of them was to be sought in the influence exerted by each atom in a complex molecule upon the properties of all the rest. To help in forming a definite conception of the way in which such an influence might be exerted, he suggested that a diatomic atom (such as O) might be compared with a magnet with its two poles, while monatomic atoms (such as Na and H) might be compared with a single isolated magnetic pole, if such a thing were capable of existing. Then, just as the south pole of a magnet would be strengthened by induction on bringing another south pole into contact with its north pole, so, by bringing an atom of sodium into contact with one pole of an atom of oxygen, the attraction of the other pole for atoms of a certain kind might be increased, although its attraction for sodium might be lessened. If this comparison of a diatomic atom with a magnet was admitted, he pointed out that, in all cases, if an atom of a given kind applied to one pole of a diatomic atom tended to strengthen the polarity of the latter, an atom of the same kind applied to the other pole would tend to weaken it in an equal degree; and hence that, as a general rule, if two symmetrical molecules, such as NaONa and HOH, came together, the forces with which the atoms were held together would be, on the whole, increased by an interchange of atoms such as would convert the above molecules into NaOH and NaOH. Professor Foster added that he did not offer these remarks as affording a solution of the difficulties pointed out by Dr. Odling, but simply as indicating a direction in which he thought such a solution might reasonably be sought for.

Mr. Chapman, in allusion to an illustration made use of by the last speaker, said that if two bar magnets were placed end to end, the north pole of one being adjacent to the south pole of the other, the sustaining power of the free end of the lower magnet was *not* augmented; but that if they were laid parallel and alongside, with similar poles adjacent, the magnetic energy of each magnet would be greatly increased. (This statement was received with manifest indications of dissent.)

Professor Wanklyn had likewise a great objection to the continued use of the word "atomicity." Ammonia and sal-ammoniac presented differences in constitution which were not easily explained, but it might happen that the *hydrogen* in these compounds had different values.

The meeting was then adjourned until Thursday, the 16th instant.

‡ In Dr. Thudichum's Tables of New Atomic Weights, Molecular Weights, and Functional Types for the Lecture-room and the Study, published by Hardwicke, Piccadilly, this terminology is adopted, and the theory of the variable dynamicity of atoms indicated on the basis of some of the best-established facts.

ACADEMY OF SCIENCES.

May 7, 1867.

(From our own Correspondent.)

M. Bertrand read a very favourable report on the memoir of M. A. Cornu, entitled, "*Théorie Nouvelle de la Réfraction Crystalline de Fresnel.*" The principal conclusions of the report were, that the luminous vibrations were normal to the plane of polarisation, as Fresnel and Cauchy announced a long time ago, though the direct proofs hitherto proposed are open to discussion.

M. Charles Robin resumed the result of his researches on the origin, development, and completion of the dorsal cord, called the cord of Owen.

The Academy proceeded to the election of a Correspondent for the Geometrical Section in place of M. Rieman. The choice almost unanimously fell upon M. Plucker, of Bonn, the well-known Professor. He received the Copley Medal of the Royal Society for 1866, and many honours which we cannot now enumerate.

M. Salmon, of Dublin, author of "Lessons in High Algebra," &c., obtained the vote left by M. Plucker.

The Academy then proceeded to the election of an Anatomical and Zoological Correspondent. M. Siebold, brother of the Japanese traveller, was elected by a large majority.

M. Balard presented an ice-making machine, made by M. E. Carré, brother of the well-known inventor of the ammonia one. Its action depends on the absorption of vapour of water by sulphuric acid, and the congelation is most rapid, as soon as the vacuum is produced.

M. Regnault, in the name of M. Soret, of Geneva, communicated a new note on the determination of the density of ozone. Experiments of absorption lead to the conclusion that the density of ozone is one and a half times that of oxygen. He applied Graham's law of diffusion—viz., that the diffusion takes place in the inverse proportion of the square of the density. He then diffused two mixtures—one of oxygen and chlorine; the other of oxygen and ozone. Thus compared, the density of ozone to that of chlorine or oxygen was found to be 1 : 5.

NOTICES OF BOOKS.

Discorso di Apertura del secondo anno della Facoltà di Chimica. Letto dal Fondatore, Prof. Carlo Cassola. Napoli. 1867.

The address of the President at the opening of the second year of a chemical college could hardly, our readers might say, contain much novelty, or any details which they could not note down beforehand. Of course he would give a general glance at the position of chemistry, the progress of discovery, and the prospects of the institution where the science was cultivated and taught. The above address does nothing of the kind. Italy has been too long under despotic rule to have retained her old courage for scientific inquiry, and now that she has happily reconquered liberty, she is only beginning to see the necessity of cultivating science as one of the most urgent means of cultivating the sources of national wealth. Hence this address is most curious and suggestive; its elementary character, its all but juvenile pretensions, have something of hope and encouragement in them; so that in laying the substance of this discourse before our readers we are sure they will join us in an expression of sympathy for young Italy, and in the hope that her intelligent sons may see the importance of the new institution and encou-

rage it in the only way that can lead to durable success—namely, by earnest study and hard laboratory practice.

The address begins by referring to the backward condition of Italy consequent on political misrule, and the paramount duty of every Italian to acquire political independence for his country. That desirable event having been accomplished, the next struggle was the endeavour to bring up their country to the level of more civilised nations. How was this to be done? Not by relying on the Government, but by their own exertions, in constructing railroads and other means of communication, developing the riches of the soil, encouraging industry; taking, in short, as their model, the Anglo-Saxon race—America and England.

The President goes on to show how false is the system of national prosperity that produces little and consumes much, exports nothing, imports everything; that produces few or no results of public education, while the population is uneasy and miserable. Trade and commerce are depressed, and those who should foster them are discouraged, because the system pursued is a false one. What is wanted for Italy is the development of her internal riches, and the knowledge how to apply science to her everyday wants.

"Banished from my native country by the political events of 1848-9, I have laboured and studied in different parts of Europe, in Asia, and the two Americas, to understand the secret of national prosperity. I returned to Italy, and excited my countrymen to follow the example of the stranger. I was laughed at! By good fortune I have had the privilege of founding this centre of instruction and research, although opposed by the Government and the municipality. The chief object of this Faculty of Chemistry is to instruct Italians in analytical chemistry and its application to industry, and then to distribute the men so educated over the country. Another object is to bring the scientific Italian out of his retirement and make his pulse beat in unison with that of his fellow-citizens—to win him, in fact, to the side of national industry and make him more esteemed in his native land."

Italy is beginning to feel the importance of the call. Various municipal and other bodies have sent minerals to be examined, and the Faculty is already in a condition to declare that Italy has undeveloped wealth in every kind of industry. Search has been made for coal, that great motive force, and in spite of the opposition of Government and of the municipality of Naples (expressions that occur more than once, and which we confess we do not understand) the province of Naples can supply that great need.

He then goes on to show how to make the exports and imports more nearly balance each other. The imports in Naples and the surrounding districts amounted to 200,000,000 lire per annum,* and the exports to only 36,000,000. He proposes to work the metallic ores of the country by means of companies, to extend railroads, &c.

The School of Chemistry, the only one in Italy (!), was founded in 1866, and has already acquired much precise knowledge as to the natural wealth of the country. It is strongly recommended that the youth of Italy be educated in the theory and practice of the sciences, in facts and observations, and not in dry themes. The Faculty has already supplied two Lyceums with the chemical apparatus required for instruction, and the University has also sought its aid. It has sent several chemists to different parts of Italy, and it carries on a wide correspondence with persons who require information on scientific subjects.

The analyses performed by the Faculty had been liberally paid for with one exception, and that was on the part of the Government. One of the departments sent a liquid to the Faculty to know if it were adulterated, and on returning the analysis the fee demanded was refused, on the ground that the Faculty was a public department, although all its documents bear the words "*iniziativa privata.*" It is stated as one of the worst features of modern Italy that it grudges the scientific man his fee, while the number of useless officials that devour the public wealth is legion.

An exhibition of national products would be useless until there is a larger number of producers. It is to be deplored that many Italians are gratified with an honourable mention and a poor medal, while the maccaronis, once especially a native product, are now made of Russian flour, and are eaten with a French fork off an English plate.

It appears that the King had offered the President a house and 400 lire per annum if he would establish the Faculty at Turin, while both house and endowment were refused in Naples. "Such," he says, "is the Government patronage of science in Italy, at a time when the Prussian Government was expending 500,000 lire on the building alone of a laboratory of instruction in Berlin." He calls upon the people to get out of the leading strings of the Government, and to think and act for themselves, although, somewhat contradictory to this advice, he suggests that a law be passed requiring every commune to set aside an annual sum for the purposes of scientific inquiry.

There are other suggestions, sensible enough in their way, but remarkable to us only for being so obvious. On the whole, we are gratified with the manly spirit of the address, in spite of a little too much self-assertion and recrimination, and think it creditable to the Government that young Italy can enjoy such freedom of speech. The very elementary nature of the address, and of the proposed remedies, show how degraded poor Italy had become under long years of political misrule. That there should be only one establishment in Italy capable of conducting a chemical analysis, and that establishment a private one, from which a University is taking lessons, is indeed a commentary on the oft-repeated proposition that when a nation loses its political freedom it must part also, sooner or later, with its science, its literature, and its art. It cannot become enslaved in body without being also enslaved in mind.

* The lira is worth 9¾d.

Chemical Notes for the Lecture Room. By Dr. Wood, F.C.S. London: W. and H. Warr and Co., Featherstone Buildings, Holborn. 1867.

For the matriculation examination of the University of London, an examination that has acquired of late years very considerable importance, a knowledge of chemistry is insisted upon quite as fully as a similar knowledge of any other branch of education. If a candidate be rejected for not gaining the minimum number of marks in any one subject, he has to pass in all the others again at a future examination. Last year 641 candidates presented themselves, and of these 334 were rejected; in 1865, 397 out of 616. An ignorance of chemistry is a very fertile cause of these rejections, and candidates generally complain of this subject as being one of "the stiffest." Very few fail, it seems, in mechanical philosophy. This is accounted for by the existence of a book, recognised as being the one necessary to work up thoroughly, and almost universally employed in the latter subject; while in chemistry the beginner, in an absolute sense, confuses himself by a mass of details, without the corresponding impression from seeing lecture experiments. Dr. Wood has endeavoured to prepare a short text-book on the subjects required, to answer the same purpose that Newth's "Mechanical Philosophy" now serves in another subject. We think that he has succeeded in a difficult task, but those who read the book will require to know it well. We need not talk of Dr. Wood's knowledge as a chemist, but we may mention that as a teacher he is widely known, and few chemists have more knowledge of what is required by candidates for the before-mentioned examination, and for whom the book is almost specially framed.

It is a capital guide book for lecture experiments, although, as the author remarks, it is in nowise intended "to supersede the excellent works of Miller, Roscoe, and others"—we presume that he means for this particular examination. It will form, as he remarks, a book of easy reference. As an additional recommendation, the wording of expressions and symbols are "the very latest out."

Guide to Croft Spa. Third Edition. Darlington: J. and J. Burney, *Telegraph* Office, High Row. 1866.

In the Chemical News, September 14, 1861, a detailed account was given of the chemical properties of the waters of this spa. It will be seen from that notice that three of the springs there contain more sulphuretted hydrogen than any other mineral springs in England. We are glad that the prosperity of Croft Village has called for a third edition of this very complete guide to its spa.

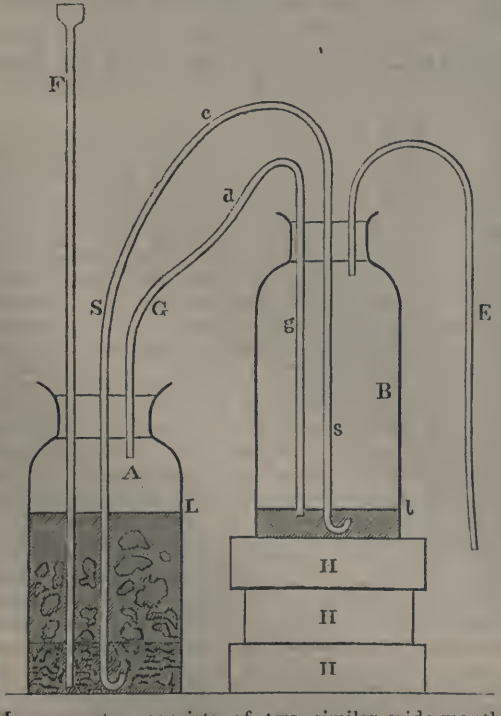
CORRESPONDENCE.

Improved Sulphuretted Hydrogen Apparatus.

To the Editor of the Chemical News.

Sir,—I venture to describe a modification of apparatus for generating sulphuretted hydrogen, which will, I trust, recommend itself to the laboratory on the grounds of compactness and cheapness, combined with effectiveness.

It consists essentially of a generator and a wash-bottle united (in addition to the ordinary connexion) by a siphon, whose legs dip to the bottom of each vessel; it occupies, therefore, the same space as the simplest arrangement, while the production of gas may be rapidly arrested or controlled at pleasure without the escape of noxious effluvia. Its cost of construction need not exceed one shilling, while it affords even greater conveniences than the more costly adaptation described at p. 152 of the *Journal of the Chemical Society*, 1864.



My apparatus consists of two similar wide-mouthed bottles, A and B, whose bungs (or, preferably, whose caoutchouc capsules) are pierced each by three holes. A is the generator, supposed in action; B is the wash-bottle, which serves also, during inaction, as a reservoir for the exciting acid; F, a tall thistle-headed funnel passing to the bottom of A, by which it is charged, and which serves also as a safety-vent; S, *s*, the siphon limbs, which dip to the bottom of each vessel, and are slightly recurved at the orifices; *c*, *d*, caoutchouc connectors; G, *g*, the transit pipes for the gas as generated, the former terminating at the top, the latter at the bottom, of their respective vessels; E, the eduction pipe; H, blocks used to relatively raise or depress each bottle as occasion requires.

Previous to operation, A is filled a quarter full of broken glass; on this are laid lumps of ferric sulphide, which are thus prevented from choking the ends of F and S; acid is poured in through F till A is three-quarters full; the siphon is then charged by nipping the other bend *d*, when the pressure of gas formed in A should be suffered to force the contained liquid over the bend *c* into B, till the mouths of *g* and *s* are covered, and the acid stands at the same level in both bottles, as in the figure L, *l*. B is then raised on the blocks H, and *d* is unnipped, when the gas will commence flowing in its normal direction through G *d g*, and, bubbling through the wash-bottle B, will pass out at the eduction tube E. When it is desired to stop the action, A is raised on the blocks, and B depressed; the former will then be emptied by the siphon into the latter; the reverse will take place, if, with a view of re-exciting the sulphide, the levels be again interchanged.

Your readers' ingenuity will suggest how, by varying the elevations, the flow of gas may be regulated to a nicety, or the charge of acid renewed without opening the bottles or emitting any smell. The eduction tube should, after traversing the solution to be impregnated with H_2S, always finally dip into a bottle of strong liquor ammoniæ, which will absorb any excess of unused gas, thus furnishing a useful laboratory reagent as a by-product.

Should the siphon become inoperative from gas collecting in its bend, which may occur through inadvertently over-emptying either bottle, or from effervescence passing up its limb S, it may be readily recharged as at starting.

Such an arrangement is of course equally applicable to other gases of daily use in the laboratory, for each of which such an inexpensive apparatus might be reserved.

I am, &c. B. W. Gibsone, M.A., B.Sc.

Eaton Square, S.W., April 8.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Periodic Acid, its Basicity.—C. G. Lautsch has examined a number of periodates without being able to give decisive evidence on this point. He is inclined to the opinion that this acid is pentatomic and tribasic, notwithstanding that a difference between atomicity and basicity has not yet been established in the case of any mineral acid. The question might be conclusively answered if it were possible to introduce into the molecule of the acid alcohol and organic acid radicals, but the oxidising power of the acid is so great that it is doubtful whether it is possible to effect this replacement.—(*Journ. prakt. Chem.* c. 65.)

Cobalt and Nickel, Equivalents of.—Dr. E. v. Sommaruga. The determination of the equivalent of cobalt was performed on Gibb's and Genth's purpureo-cobaltic chloride; this salt was dried perfectly by many hours' heating at 110°, weighed, heated till the ammonia, ammonic chloride, and water were wholly expelled. The resulting very hygroscopic cobaltic chloride was then reduced by hydrogen; the metallic cobalt was weighed, and gave a mean of seven determinations 29·965, maximum 30·009, minimum 29·916.

The nickelo-potassic sulphate was used for the deter-

mination of the equivalent of nickel. To prepare this salt, commercial nickel was dissolved in dilute sulphuric acid, to which nitric acid was occasionally added; a quantity of potassic sulphate, insufficient to combine with all the nickelic sulphate, was added to the filtered solution; the solution was evaporated to crystallisation, and the crystals, after washing out the nickelic sulphate, were recrystallised several times. The final product worked on still retained traces of cobalt, but no other impurity. The crystals were dried at 100° and weighed; the sulphuric acid was determined as usual, and the equivalent of nickel calculated from the weight of baric sulphate. The mean of six experiments was 29·013; maximum, 29·079; minimum, 28·911. The proximity of these numbers to those obtained by R. Schneider from different experimental bases supports the author in assigning to cobalt the equivalent 30, to nickel 29.—(*Sitzungsber. Akad. Wien*, June, 1866.)

Vapour Density, Determination of.—R. Bunsen. As the omission of one minute detail would, in performing determinations by this method, render the result worthless, an abstract of this wonderful paper would be of little value, and no abstract could give an idea of the astonishing delicacy of the operations described; we therefore refer readers to the original, remarking that with carbonic dioxide, six experiments, in each of which less than ·35 gramme was employed, a mean 1·527, maximum 1·529, minimum 1·525, were found. Regnault, working on 19 grammes, found 1·529.—(*Ann. Chem. Pharm.* cxli. 273.)

Fatty Acids, Chloro-derivatives of (C=12).—Dr. W. Schlebusch. Hypochlorous acid does not unite with fatty acids, but introduces chlorine into their molecule; the acetic acid chloro-derivative is difficult to obtain; valeric acid gives chlorvaleric acid, described by Clark and Fittig. Valerolactic acid and its baric, cupric, and argentic salts are described. Butalanine $C_5H_{11}O_2N$ was obtained by heating the crude chlorvaleric acid with absolute alcohol saturated with ammonia. After a few hours' exposure in sealed tubes to 120°, the solution was evaporated to expel ammonia and alcohol, heated with baric hydrated oxide to decompose ammonic chloride, freed from baric salts by sulphuric acid, and evaporated to crystallisation. Butalanine combines with acids. With chlorhydric acid transparent plates are formed.—(*Ann. Chem. Pharm.* cxli. 322.)

Carminic Acid (C=12).—H. Hlasiwetz and A. Grabowski. Carminic acid, when boiled with dilute sulphuric acid, splits into carmine red and sugar; the latter reduces Trommer's solution, and gives Pettenkofer's reaction, but neither ferments nor acts on polarised light; traces of it are dissolved by alcohol. Dried at 50°, its formula was $C_6H_{10}O_5$; at 100°, $C_6H_8O_4$.

Carmine red, $C_{11}H_{12}O_7$, is a dark purple amorphous substance, reflecting green light, soluble in water and alcohol, with a fine red colour; insoluble in ether. Like carminic acid, it pertinaciously retains traces of phosphates; its alcoholic solution, when treated with alcoholic potash solution, deposits the whole of the carmine red as $C_{11}H_{10}K_2O_7$, from which the corresponding baric and calcic compounds were obtained. Powerful reducing agents perfectly decolorise the solution of carmine red, but the resulting body could not be separated in a pure state. Fused with potash solution of appropriate strength, carmine red gives oxalic and succinic acids, and coccinin—probably $C_{14}H_{12}O_5$—a body resembling chinon. Its crystals polarise light, are insoluble in water, easily soluble in alcohol, difficultly so in ether. Coccinin dissolves very easily in dilute alkaline solutions, and in such solution is one of the most sensitive bodies to the action of oxygen. The solution is at first yellow, then violet, finally a magnificent purple red. Few bodies give rise to so many phenomena of colour as coccinin.

From the splitting of carminic acid into carmine red and sugar, perhaps Schützenberger's is the nearest to the real formula—probably $C_{17}H_{18}O_{10}$—of that much-investigated body.—(*Ann. Chem. Pharm.* cxli. 329.)

Rufigallic Acid, a Derivative of (C=12).—G. Malin. Rufigallic acid was fused with potash, and gave among other things a straw-coloured body crystallising in very slender needles soluble in boiling water, in alcohol, and in ether, sparingly soluble in cold water, reacting acid, decomposed by heat; its aqueous solution reduced argentic and alkaline cupric solutions; it did not appear to combine very definitely with anything. Its formula is $C_6H_4O_3$, and its name oxychinone.—(*Ann. Chem. Pharm.* cxli. 345.)

Resins rendered Soluble.—H. Violette. Copal and other refractory resins are soluble in oil of turpentine, &c., if they have been heated for 15—20 minutes to 350—400°, of course in closed vessels. The best way of operating is to heat the resin for a few minutes in an open vessel; 5 or 6 per cent. of water are by this means expelled. The vessel is then closed, and the heating continued. The product gives very excellent varnishes. To avoid the necessity of heating the varnishes made as described, in order to brighten them, the oil, &c., which it is intended should be used, may be heated together with the resin. The product then simply needs dilution.—(*Ann. Chim. Phys.* [4]. x. 310.)

Phosphorous Acid (O=16).—Rammelsberg. The examination of compounds of phosphorous acid with dyadic metals leads to the conclusion that this acid exists in three states, corresponding to the ortho-, pyro-, and meta-phosphoric acids. Thus the (K′, Na′, Am′), together with the (Pb″, Cu″, Cd″, Mn″, Co″, Ni″?) salts, which may respectively be typified by HR'_2PO_3 and $HR''PO_3$, point to $\left.\begin{matrix}H_2\\H(PO)''\end{matrix}\right\}O_2$, corresponding to metaphosphoric acid, The (Ba″, Sr″, Ca″, Ni″?, Zn″?) salts give $H_8P_2O_7$, otherwise $\left.\begin{matrix}H_6\\2H(PO)''\end{matrix}\right\}O_5$, corresponding to pyrophosphoric acid, and the magnesic salt, though less decisively, indicates $\left.\begin{matrix}H_4\\H(PO)''\end{matrix}\right\}O_3$, corresponding to orthophosphoric acid. An ethylic salt, in which the hydrogen is wholly replaced by ethyl, is represented by $\left.\begin{matrix}2(C_2H_5)\\C_2H_5(PO)''\end{matrix}\right\}O_2$. It is to be observed that whilst the acid radical in phosphoric acid is triadic, that in phosphorous acid, having one bond saturated by H, is only dyadic H(PO)″; similarly the acid radical of hypophosphorous acid is only monadic $H_2(PO)'$. —(*Monatsber. Berl. Akad.* Aug. 1866.)

Ethylic Chloracetate, Action of Ammonic Carbonate on.—W. Heintz. The acids of the lactic series possess at once the functions of acids and alcohols, their basicity remaining unaltered by the replacement of hydrogen by acid radicals; and as under the influence of dyadic metals two molecules of acid will unite in order to furnish two replaceable atoms of H basylous, so under the influence of acid radicals should two molecules unite to furnish H_2 chlorous. The preparation of ethylic succinyl-lactate proves the correctness of this view. Dyadic carbonyl not having been used in a similar reaction, an attempt was made to effect this molecular combination by means of sodic carbonate, but the product was too small to be useful. Ammonic carbonate was therefore employed, it seeming likely that its volatility would assist the reaction, but an examination of the products obtained showed that carbonic acid did not intervene in the reaction which really did occur, the result of the experiments being that ethylic tri-, and probably di-, glycol-amidate were produced.—(*Ann. Chem. Pharm.* cxli. 355.)

Cupric Persulphide (Cu=63·5, S=32).—A. Gescher. Bloxam's body $Cu_2(NH_4)_2S_7$ was prepared by making a solution of ammonic persulphide of such strength that a sample of it, mixed with an ammoniacal solution of cupric sulphate, deposited on standing red crystals quite free from black cupric sulphide. The right strength being

attained, the solutions were mixed in bulk. To the crystals so obtained the formula $2CuS_3 + (NH_4)_2S$ is attributed.—(*Ann. Chem. Pharm.* cxli. 350.)

MISCELLANEOUS.

Death of Walter Crum.—Many of our readers will hear with regret of the decease of Mr. Walter Crum, which took place on the 4th inst., at Thornliebank. Mr. Crum had been for more than twenty years a Fellow of the Royal Society. His papers, chiefly on subjects connected with calico-printing, were numerous, and bore the stamp of great talent and originality; we may especially mention his researches on Indigo, on the Acetates of Alumina, on Mordants in Dyeing, on Cotton-fibre, &c. By his death the Chemical Society loses one of its original Fellows and a respected Vice-President.

Analysis of Earth eaten in Borneo.—Some few years ago the manager of the Orange-Nassau colliery, near Zandjermasin, in the Island of Borneo, found that many of his workpeople (natives) consumed large quantities of a kind of clay; a sample of this material was forwarded to Batavia for analysis, and the following is the result in 100 parts:—

Pitcoal resin (organic matter volatile at red heat)				15·4
Pure carbon	,,	,,	,,	14·9
Silica	,,	,,	,,	38·3
Alumina	,,	,,	,,	27·7
Iron pyrites	,,	,,	,,	3·7
				100·0

We remind our readers that the eating of clay is a custom to which savages—or, at least, human beings of a very low degree of development—are freely given in various parts of the world. No other analyses of any of the substances used as such have been made, or at least, if made, they have not been published. The resident military medical officer at the above-named colliery is strongly inclined to consider it the duty of the manager to eradicate and discountenance this habit of the workmen, as it appears to injure their health.

Meetings for the Week.

Tuesday, May 14.

Royal Institution, 3 p.m. Professor Miller "*On Spectrum Analysis.*"

Royal Medical and Chirurgical Society, 8½ p.m.

Photographic Society, 8 p.m.

Wednesday, May 15.

Society of Arts, 8 p.m.

Pharmaceutical Society, 8 p.m. Anniversary.

Thursday, May 16.

Royal Institution, 3 p.m. Professor Huxley "*On Ethnology.*"

Royal Society, 8½ p.m.

Chemical Society, 8 p.m.

Friday, May 17.

Royal Institution, 8 p.m. Professor Odling "*On Absorption of Gases by Metals.*"

Saturday, May 18.

Royal Institution, 3 p.m. Professor Huxley "*On Ethnology.*"

NOTES AND QUERIES.

Colours from Caramel.—Sir,—Perhaps the following information may be of use to your correspondent:—The secret consists in using glucose and heating it with an alkali. For vinegar, carbonate of ammonia is required, as a fixed alkali produces turbidity. 120 lbs. of glucose require 6 lbs. of carbonate of ammonia and 6 lbs. of water. Heat together in a metal boiler till the glucose is of the desired colour, keeping the mixture well stirred. Then add 30 or 40 lbs. of warm water poured in a thin stream.—F. Thompson.

Glass Drilling.—A correspondent, D. F., informs us that the process for working glass with files, drills, or other tools of steel, moistened with dilute sulphuric acid, as given by Dr. Lunge in the last number of the Chemical News, was the subject of a patent taken out by Maudsley some years back.

Nitro-benzol.—Sir,—In reply to "Manufacturer," I beg to inform him that I have prepared nitro-benzol nearly colourless, and with a pure fragrant odour, by distilling it much below its boiling point in a current of steam. The first portions, which contain benzol, &c., are to be rejected.

Chinese Blue.—We have received several communications on this subject, in answer to a query in our last number. If "R. H. W., Manchester," will send an address, they shall be forwarded.

Light Coal Oil.—Sir,—Have any of your readers tried a plan of mixing the light oil obtained from coal tar with a solution of chloride of lime, and submitting the mixture to distillation? If so, what changes have been noticed, and what was the action on the sulphur compounds?—M.

Caramel Colours.—If "E. A., Glasgow," will send his address, we will forward several communications which have arrived on this subject.

Calico Printing.—Sir,—I have spent over three years in trying to improve various colours now in use by calico printers and dyers. I shall be glad if you could assist me in obtaining a little ready money for the following important discovery:—I can print on cotton goods a mordant that will produce a perfectly fast mauve, with, or at the same time as, garancine work, more fast and bright than any produced previously. I can dye all aniline colours faster and brighter than they have ever been done, and at a much less expense, on any kind of fabric. I can also produce the same shade of colour on mixed goods at one operation, and which is both cheap and simple. I will render every explanation necessary to any one applying through you or your valuable paper, and give any security and guarantee.—J. K. M.

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. 6d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

Owing to the length to which our report of the Chemical Society extends, we are compelled to omit articles by Dr. Muspratt, Dr. Maisch, and others, together with several reviews, reports, and letters.

W.—Crucible is derived from the Latin *crucio*, to torture or twist.

F.R.A.S.—The letter has been forwarded.

Townsend, Hook, and Co.—The address shall be sent. The author is preparing an article on the subject for these pages.

W. Beckett.—The syrup of orange and quinine appears likely to be of value in cases where orange wine and quinine would be injurious to the system.

Constant Reader and *Another Person.*—Sunlight shining on a fire will not put it out nor prevent combustion. The explanation of the popular opinion on this point is, that the light of the sun is so immeasurably superior to that of the fire, that the latter appears to lose its brilliancy when sunlight falls on it, and to an ordinary observer would seem dead.

T. S.—We should be pleased to receive the information in a form suitable for publication.

M. M. Soc.—The animal matter may be removed from the sections of bone by soaking them in caustic potash. The alkali must be well washed out before mounting the sections. Canada balsam is best for the latter purpose.

Books Received.—"The Calculus of Chemical Operations; being a Method for the Investigation, by means of Symbols, of the Laws of the Distribution of Weight in Chemical Change. Part I. On the Construction of Chemical Symbols." By Sir B. C. Brodie, Bart., F.R.S.—"Dr. Ure's Dictionary of Arts, Manufactures, and Mines." Edited by Robert Hunt. Vols. I., II., and III.—"A Dictionary of Science, Literature, and Art." By W. T. Brande and Rev. G. W. Cox. Vols. I., II., and III.

Communications have been received from Dr. Adriani; J. H. Swindells; A. Jaeger; T. Sherlock; J. Kenyon; R. Hulse; J. C. Bell, F.C.S.; G. Thompson; Lewis, Ash, and Co.; A Subscriber; A Constant Reader; James Browne and Son; E. Tate; Messrs. Huskisson and Son; P. Squire; Johnson and Sons; Another Person; Gaskell, Deacon, and Co.; Allhusen and Son; May and Baker; J. R. Haas and Co.; W. Beckett; Townsend, Hook, and Co.

ELECTION OF FELLOWS AT THE CHEMICAL SOCIETY.

It was suggested last week that it would probably be necessary to alter some of the By-laws regulating the admission of Fellows into the Chemical Society, and we stated that the problem to be solved was how to guard against the admission of unfit persons, and at the same time to prevent the ballot becoming an organ for the gratification of personal pique. On looking more carefully into the Charter and By-laws of the Chemical Society, it appears that there is to be found a very simple solution of the latter part of this problem. Attention being drawn to the subject, it has not failed to strike most persons as manifestly unjust that the decision on an important question, brought before a meeting of the members, should be determined according to the wishes of the minority; and it shows how harmoniously the Society and its officers have hitherto worked together that this hardship has never been felt before. On his admission, each Fellow received the regulations of the Society, together with sundry other formal documents; but we venture to say that not many looked at them a second time, and few will now be able to lay hands on a copy of the Charter and By-laws, to which we now propose to direct attention. When everything is going on smoothly, the laws and regulations of the Society are dormant.

It now appears that for many years the Society has been acting contrary to the Charter, in electing Fellows, honorary and foreign Members, and Associates, according to the existing By-laws.

By the third paragraph of the Charter of Incorporation, granted to the Society in 1848, it is declared—

"That at all General Meetings and meetings of the Council the majority present and having a right to vote thereat respectively shall decide upon the matters propounded at such meetings."

Again, the concluding paragraph of the Charter declares,

"That no resolution or by-law shall, on any account or pretence whatsoever be made by the said body politic and corporate in opposition to the general scope, true intent and meaning of this our Charter; and that if any such rule or by-law shall be made, the same shall be absolutely null and void to all intents, effects, constructions, and purposes whatsoever."

Now, it is very evident that the By-law, making the election of a candidate depend upon the votes of three-fourths of the Fellows present, is in direct contravention to the "true intent and meaning" of the first-quoted paragraph of the Charter; and therefore such By-law is, according to the terms of the second citation from the Charter, "absolutely null and void to all intents, effects, constructions, and purposes whatsoever."

But it may be argued that the third paragraph of the Charter refers only to anniversary meetings or extraordinary meetings of the Society. An attentive examination will, however, show that by the term "general" meeting is intended that which is now commonly called an "ordinary" meeting. The term "*ordinary* meeting" strictly means *regular* or *customary* meeting; a *general* meeting means one public or common to the whole of the Fellows. Custom has sanctioned the omission of the word "general" as qualifying the ordinary meetings, but it is still retained in By-law, which speaks of an *extra*-ordinary general meeting, which, logically and grammatically, can only mean a *general meeting* held *extra*, or in addition, to the *ordinary* bimonthly meetings.

The term "general meeting" occurs several times in the Charter, but nowhere do we find the terms "ordinary" and "anniversary" meetings. When, however, we refer to the regulations of other learned societies, no longer can there be any doubt as to the meaning of the term "general" meeting. In the Charter of the Royal Society no mention is made of meetings of the members, ordinary, extraordinary, or general. But in the Charter of the Zoological Society the term "general" meeting is used in a sense applicable only to ordinary meetings; and in the By-laws the monthly meetings of the Society are invariably spoken of as "general meetings," or "ordinary general meetings." In the Charters of the Linnæan and Geological Societies likewise the term "general meeting" is used to express the ordinary meetings of the members, and in the By-laws these are invariably termed "general" meetings; the 9th section of the rules of the latter Society, in fact, state that "the *general* meetings to be held by the Society shall be of three kinds:—1. *Annual*; 2. *Special*; 3. *Ordinary*." It cannot, therefore, be doubted that the term "general" meeting in the third paragraph of the Charter of the Chemical Society means the same as the term "ordinary" meeting does in the By-laws.

No one, we imagine, will dispute that the election of Fellows is a "matter propounded" at a meeting upon which the "majority present" are to decide. On the contrary, the question as to whether a candidate is to be admitted to the Fellowship of the Chemical Society is a very important matter propounded to those present who have a right to vote, and the question, above all others, which should be carried by a numerical majority.

In strict logical interpretation, therefore, those candidates who were blackballed at the recent meetings of the Society were excluded from the Fellowship in error. A numerical majority of voters were in favour of their admission, and at the present time the blackballees are as strictly entitled to the letters F.C.S. as are any of the blackballers.

We confess we see only one course to be pursued in respect to the By-laws which remit the decision on such important matters as the election or removal of Fellows to a small minority, in opposition to the wishes of the great bulk of those present. Strictly speaking, these restrictive By-laws never had any legal existence, and they should at once be replaced by others in conformity with the Charter.

One half of the problem now under discussion—that of preventing voting by ballot becoming an organ for the gratification of personal pique—has solved itself in a manner which leaves nothing to be desired. The first

part of the question—How to guard against the admission of unfit persons into the Society—is one in which Council and Fellows are free to act, for the Charter specially provides that they "may alter, vary, or revoke, and may make such new and other By-laws as they shall think most useful and expedient for the said body politic and corporate, so that the same be not repugnant to these presents." Thus the way is clear to a satisfactory settlement of the recent unwarrantable proceedings and the permanent prevention of their recurrence, and to the establishment of safeguards against the degradation of the Fellowship of the Chemical Society.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Direct Production of Stilbene from Bitter Almond Oil, by C. GREVILLE WILLIAMS, *F.R.S.**

STILBENE was obtained by Laurent by the distillation of hydride of sulpho-benzoyle, according to the equation—

$$\underbrace{8C_7H_6S}_{\text{Hydride of sulpho-benzoyle.}} = 2CS_2 + 3H_2S + 2\underbrace{C_{14}H_{12}}_{\text{Stilbene.}} + \underbrace{C_{26}H_{18}S}_{\text{Thionessal.}}$$

The simplicity of the relation between hydride of benzoyl and stilbene made me conceive that the latter might be produced directly from the former; thus—

$$2C_7H_6O + 4Na = C_{14}H_{12} + 2Na_2O.$$

Experience has completely confirmed this supposition. The reaction, however, as might be expected, does not take place without the formation of other products. In fact, the amount of stilbene produced is so small, and the difficulties in the way of the separation of the substances produced are so considerable, that I should have delayed publishing my results in their present state had I not seen that Claus† is working in a somewhat similar direction. However, as he employs sodium amalgam and an etherial solution of hydride of benzoyl, instead of hydrocarbons, he obtains bodies containing oxygen. One of the substances produced in the manner indicated is the salylic acid, $C_7H_6O_2$, of Kolbe and Lautemann, and the other appears to be identical with Church's dicresol, C_7H_7O.‡

To obtain stilbene I treated the bitter almond oil of commerce with an equivalent quantity of sodium, and distilled the mixture at a temperature sufficiently high to bring over everything volatile. The distillate was again treated with sodium and fractionally distilled. One portion came over below 200°, and contained volatile liquid hydrocarbons, among which benzol was observed. The fraction distilling between 200° and 244° did not yield any crystals, even when exposed to a freezing mixture of ice and salt. That portion of fluid which distilled between 244° and 265° became nearly solid on cooling. Above 265° the distillate consisted chiefly of crude stilbene. The fluid distilling between 200° and 244° contained carbon 85·3, hydrogen 8·1, oxygen 6·6. It was apparently a mixture, and probably contained a small quantity of stilbene in solution.

The solid substance was dissolved in hot benzol, and on cooling gave a crop of beautiful colourless prismatic crystals, which, when perfectly freed from benzol by exposure for some time to a temperature of 100°, gave the product *a*. The mother liquid, on standing, gave a second crop *b*, which was freed from benzol in the same manner as the first. The third crop *c* was only purified by pressure between folds of filtering paper. The residue, evaporated to dryness and sublimed, gave crop *d*. The melting points were as follows:—

a	113°
b	116°
c	78°
d	100°

The second crop was burned with oxide of copper and oxygen gas, with the annexed result:—

0·2227 gramme of crop *b* gave
0·7642 ,, carbonic anhydride, and
0·1374 ,, water.

Or, per cent.:—

	Experiment.	Calculation, Stilbene.	
Carbon	93·59	93·33 C_{14}	168
Hydrogen	6·85	6·67 H_{12}	12
	100·0		180

Agreeing, therefore, with the formula $C_{14}H_{12}$, which is that of stilbene.

The melting point of the specimen analysed was 116°. Laurent does not give the melting point of stilbene, but merely states that it fuses several degrees above 100°.

The vapour density of stilbene as given by Laurent is 8·4, a number which is entirely incompatible with the formula. Therefore, although I only had a very minute portion (less than two decigrammes) of stilbene left, I resolved to repeat the vapour density determination, feeling sure that even if the experimental result was not so accurate as might be desired, it would still be a sufficient approximation to indicate the true formula of the substance analysed. The experiment was made in an atmosphere of mercury vapour, with the annexed result:—

Excess of weight of balloon	0·1371 gramme.
Temperature of vapour	350°
Temperature of air	17°
Pressure	764 m.m.
Capacity of balloon	95·5 c.c.
Residual air	12·5 c.c.

Experiment.	Calculation.
6·024	6·228

The large amount of residual air, and the smallness of the scale on which the experiment had to be made, make me regard this experiment as one requiring to be repeated. It is, however, quite near enough to the theoretical value to show that the number obtained by Laurent was due to some error of experiment.

It is important to observe that the specimen of stilbene which fused at 116° had its melting point raised to 120° by keeping it for some hours at a temperature of 100°. It is evident, therefore, that the fusing point of stilbene is not lower than 120°.

Recent Analysis of the Montpellier Saline Chalybeate (Kissingen) Spring at Harrogate, by Dr. SHERIDAN MUSPRATT, *M.D. (Hon.), F.R.S. Ed., M.R.I.A., &c.**

As there have been so many strange analyses, some most conflicting, of the water of the above celebrated spring,

* Communicated by the author.

† *Ann. der Chem. und Pharm.* cxxxvii. 92. "Ueber die Einwirkung von Natriumamalgam auf Benzoylwasserstoff in ätherischer Lösung."

‡ *Ibid.* cxxviii. 301.

* Communicated by the author.

I have for some months been engaged with experiments and researches upon it; and feeling that the results elicited are now the true ones, I place them before the readers of your ably conducted journal. In the CHEMICAL NEWS for June 29, of last year, it is stated that this Kissingen spring holds the following:—

Carbonate of baryta	7·657
Carbonate of strontia	2·815

Neither of these earthy carbonates is contained, as such, in the water. The barium exists as a chloride—*i.e.*, in the same form as it does in the "Dr. Muspratt chalybeate, or chloride of iron spring." Annexed is the new analysis, collaterally with that of my friend Dr. Hofmann:—

	Grains in the imperial gallon. 1854. Dr. Hofmann.	1867. Dr. Muspratt.
Carbonate of iron	2·790	3·719
Carbonate of lime	—	21·011
Carbonate of magnesia	41·796	2·074
Carbonate of manganese	trace	trace
Chloride of sodium	656·838	700·500
Chloride of calcium	159·278	168·450
Chloride of magnesium	35·635	81·560
Chloride of potassium	11·383	6·916
Chloride of barium	—	6·364
Chloride of strontium	—	traces
Chloride of lithium	—	traces
Silicic acid	0·947	0·438
Ammonia, &c.	traces	traces
	908·667	991·032
Cubic Inches of the Gases in One Gallon of the Water.		
Carbonic acid	24·17	21·33
Carbide of hydrogen	2·40	2·74
Oxygen	·51	·77
Nitrogen	6·48	5·92
	33·56	30·76

The quantity of chlorine in the gallon was estimated by my assistant, my brother Edmund, five other chemists, and myself, and the mean (by weight and volumetrically) was 596·472 grains per gallon. The total amount of chlorine in June, 1865, was 510·17 grains per gallon; in March, of this year, I found 592·5 grains. From the recent analysis, the water is much stronger in its saline ingredients; besides, it has acquired others (chlorides of barium, &c.) that did not exist in it previously. When the late Mr. West, of Leeds, analysed the water from this spring many years ago (1844?), he gave 20 grains of sulphate of soda in the gallon. If this salt was present then—it could not possibly be there with chloride of barium—it is not now found in any of the strongly impregnated waters of Harrogate, "the queen of northern spas," as justly styled by Dr. Granville. The springs to which Harrogate owes its celebrity exceed in number those of any other place in the kingdom.

College of Chemistry, Liverpool, May 1.

TECHNICAL CHEMISTRY.

Notes on Thallium and Magnesium Alloys, by S. MELLOR, *Esq., Manager of the Magnesium Metal Company.**

IT having been suggested that if an alloy of thallium and magnesium could be easily made into wire it might be found to burn readily and to produce an intense bright green flame, which, from its portability, would be well adapted to some of the purposes for which a green flame is required, some experiments have been made with this end in view.

It was found that thallium alloys most readily with magnesium, and in any proportions. The alloys are very stable, and are easily worked up into wire and ribbon. Alloys containing 5, 10, 15, 20, 25, and 50 per cent. of thallium were prepared. These all burn brightly and steadily, but the flame is smaller and the combustion slower than that of pure magnesium. The flame is cold, and the heat-conducting property of the alloy, compared with magnesium, is sensibly diminished, showing the change in the molecular construction of the metal. The smoke produced in the combustion of these alloys is more dense, and as it curls gracefully away it is seen to be fringed with a rather pretty dark purple tint; but the magnesium light is so very intense that it almost completely masks the thallium flame, so that it is not observable in some of the alloys—indeed, the green light is scarcely recognisable even in an alloy containing 50 per cent. of thallium.

An alloy of 5 per cent. of thallium appears to render magnesium less brittle and more ductile than pure magnesium is usually produced; but the higher alloys of thallium, say those containing 25 and 50 per cent. of thallium, are more oxidisable than pure magnesium.

The metals were put together cold in a closed iron crucible; only a slow heat was required to melt them.

* Communicated by the author.

PHARMACY, TOXICOLOGY, &c.

On Colchicia, by JOHN M. MAISCH.*

THE collection of chemicals in the Philadelphia College of Pharmacy contains a specimen of colchicia prepared by Mr. Carter in 1857; a portion of this was used for the purpose of clearing up the contradictions in the statements of different authors. The substance is a light yellow amorphous powder, possessing a very faint odour and intensely bitter taste, sparingly soluble in ether, but easily soluble in water and alcohol, the aqueous solution being slightly turbid, most likely in consequence of the decomposition of a small portion into resin and colchicein. Heated upon platinum foil, it fuses; at a higher heat, it takes fire and burns without leaving any residue. Placed upon moistened red litmus paper, the blue colour is restored; very faintly reddened litmus becomes blue also by a concentrated aqueous solution. One drop of dilute sulphuric acid dropped from a bottle giving fifty-two drops to the fluid drachm, consequently about one-eighth of a grain HO,SO_3, when mixed with one grain of colchicia, retained its acid reaction. One drop of the acid was mixed with one fluid ounce of distilled water; in five minims of this mixture, equal to about one-seven hundred and seventieth grain HO,SO_3, one-sixteenth grain colchicia was dissolved, and the solution now had a distinct alkaline reaction on slightly reddened litmus paper; but on heating this solution to the boiling point, it had acquired an acid reaction.

The most important tests for recognising the presence of colchicia are its behaviour to dilute acids and also alkalies, by which its solution acquires a yellow colour, and the violet and blue colour which is produced by oxidising agents with dry colchicia. This latter coloration, which changes through various shades finally into yellow, is strikingly beautiful when concentrated sul-

* Abstract of a paper in the *American Journal of Pharmacy*, xxxix. 97.

phuric acid is used and immediately some nitric acid or a fragment of a nitrate is added; strong nitric acid produces it likewise, but it changes more rapidly to yellow. Sulphuric acid with a trace of chromate or bichromate of potassa, or of sesquichloride of iron, or of binoxide of lead, shows the same reaction at the point of contact with colchicia; the liquid itself has a green colour with the first two reagents, owing to their intense yellow colour.

One grain of colchicia was dissolved in one fluid ounce of distilled water, slightly acidulated with muriatic acid; by repeated trials it required 114 drops from this phial to make one fluid drachm; this measure had been carefully gauged with a pipette graduated into $\frac{1}{100}$ c.c. In making the following experiments, a sufficient amount of the reagent was added to enough distilled water to make one fluid ounce, and the solution of colchicia was carefully dropped in until, after stirring, a permanent turbidity was observable. Under these circumstances, it was required of

Mayer's iodohydrargyrate of potassium, 15 drops; turbidity quite distinct.
Sonnenschein's phosphomolybdic acid, 20 drops; turbidity distinct.
Tannic acid, 100 drops; turbidity scarcely observable.

It follows from this that the following amounts of colchicia may be detected by

Mayer's test . .	·01645 grains, or	1 part in	27700 water.†
Sonnenschein's test	·02193 ,,	,,	20778 ,,
Tannic acid . .	·10965 ,,	,,	4156 ,,

Solutions of colchicia in water acidulated with sulphuric and with muriatic acid were evaporated and taree times taken up by water and again evaporated; tne aqueous solutions were finally filtered from the separated resin, and the filtrate slowly evaporated with an excess of carbonate of lead, the residue then treated with strong alcohol and slowly evaporated. Colchicein was obtained in yellowish crystals, which were free from acid and lead. Dissolved in water it still yields precipitates with tannin, phosphomolybdic acid, and iodohydrargyrate of potassium; but neither in solution nor in substance does it produce any reaction on red or blue litmus paper. Rendered faintly alkaline by ammonia, the solution occasions precipitates with the soluble salts of barium, calcium, and lead, which are soluble in dilute nitric acid. Towards acids it behaves similarly to colchicia.

The resinous matter remaining on the filter when colchicein is filtered off was dissolved in alcohol, and the solution evaporated; an amorphous brown-greenish mass was left, in which alcoholic solution has a decided acid reaction. Concentrated nitric acid dissolves it with an evanescent yellow colour; on the addition of sulphuric acid the solution takes place with a purplish brown, rapidly disappearing; pure sulphuric acid dissolves it with a brown colour.

Having looked in vain in every portion of the decomposed colchicia for glucose, or a compound which would reduce an alkaline solution of copper, the observations of Oberlin, Ludwig, and Hübler are confirmed.

Taking all these results together, no doubt colchicia must be looked upon as an alkaloid, the salts of which are soluble in water, but decomposed, with the formation of colchicein, on keeping them in solution as well as on evaporating them. The crystalline mass, obtained by Mr. Carter on evaporating sulphate of colchicia, was undoubtedly colchicein.

† One fluid ounce water = 455·669 grains.

Aschoff and Bley observed already that colchicia combines with bases, and that when it is evaporated with a solution of the carbonate of an alkali, the residue contains no carbonic acid. Hübler makes it probable that colchicein is formed under these circumstances. Colchicia is a very weak base, and colchicein, if it can be regarded as an acid, is certainly a weak one, and resembles the alkaloids in its behaviour to some reagents. If colchicia and colchicein have the same composition, the acid resin formed together with the latter can scarcely be different.

In preparing colchicia the action of alkalies and acids, particularly when heat is applied, must be avoided.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, May 15, 1867.

The Academy of Sciences includes in its body four sorts of members—titular, foreign associates, free academicians, and correspondents. According to the spirit which animated its creation under the ancient monarchy, the free academicians were ordinarily high-placed men, or at least men occupying an elevated position in society, well known to be the friends of science and disposed to patronise it. They had all the rights and privileges of titular academicians—that is to say, they took part in all the elections, could form part of all the administrative or other commissions, &c. They did not receive the small stipend attached to the rank of member of the Academy, but they took their share of the presentation tickets. In this primitive state of things, the title of free academician was superior to that of the titular one, and it was ridiculous to ask the first-named to abdicate in favour of the latter. At the time of the re-organisation of the Institute of France and of the five academies which compose it, the democratic spirit which predominated at the discussion of the regulations—at least, as far as concerned the Academy of Sciences—ended by putting the primitive and very legitimate institution of the free academicians in a false position, and in reducing their body to an inferior number, and thus subjecting them to humiliation, though they were always chosen from the first ranks. For example, they are deprived of their votes in the elections of titular and corresponding members, and they cannot take part in any elections except for free members like themselves. In our opinion this inferiority, contradictory in itself, ought to have disappeared long ago, the more so as it keeps up in the Academy an antagonism much to be regretted, and a mutual silent but deep-seated discontent, which has already given rise to violent discussions, and, we are sorry to say, combats with arms less noble and worthy of the members. At this moment the fire is smouldering under their feet, and may burst out as a volcano. Among the ten free academicians, three—Marshal Vaillant, M. Antoine Pussy, Count Jaubert—are present or former Ministers of State. The most ardent advocate in defence of the rights of the corporation is the Count Jaubert, well backed by the most ancient of his colleagues, Baron Sequier, a distinguished amateur mechanical engineer, formerly councillor at the Royal Court of Paris. Marshal Vaillant does not take any visible part in the conflict, but he nevertheless is mixed up in it, perhaps with a sort of disgust at the proscription with which the free academicians are struck, and he hopes, openly, but timidly, to push into the list of the titulars. A most distinguished officer of the French military engineers, universally informed, an ingenious and popular writer, an eminent agriculturist and meteorologist, he had, in the judgment of François Arago, and, we may say, of everybody else, all the talents and qualities for a titular academician; no one could be more fitted to fill a chair actively. It was a good occasion for granting his

request. Not without his high influence the Academy entered into possession of their new chair; if the Marshal had not objected, the Emperor would have, according to the accustomed usage, named by a decree the first titulars, and in the first place Marshal Vaillant. In how many circumstances the Marshal has been the ready and powerful intermediary between the Academy and the executive for the foundation of new prizes, the increase of the value of existing ones, or the concession of scientific missions! He has been advised to resign his position as a free academician, and to be proposed as candidate for the place of titular academician in the section corresponding to his works. He will not do that; he cannot, on account of the respect for those who share the seat with him—a seat awkwardly lessened not in dignity but in rights. He declares that he puts himself solely at the disposal of the Academy, and that, although he will not resign his present chair, he will accept with gratitude the chair of titular academician.

What is wanted more? Can we understand how a body formed of such celebrated scientific men can much longer hesitate in acquitting what we do not fear to call a debt of honour and gratitude? Marshall Vaillant had two votes in the last election, and we have heard them named as unconstitutional. This is a farce, and these two votes must absolutely become unanimity for the election of the Marshal in the Section of Geography and Navigation. Thus, if the Academy of Sciences does not decide upon rendering to the free academicians their primitive rights of participation in all the elections, it ought at least to suppress the derisive term; for it is repugnant to common sense now to have only the mutilated honour of a free academician.

We have not succeeded in ascertaining at all definitely the series of the deliberations and the awards of the juries. We know, however, that in Class 72, Group VII.—sugars and confectionary products—the jury propose to award four gold medals: the first to Prussia, the Zollverein exhibitors, for the *ensemble* of their products, and especially the sugars manufactured directly and ready for immediate delivery for consumption; the second to the Mauritius for the considerable increase in the production and the progress accomplished; the third to M. C. A. Say for the products of his refinery, an excellence demonstrated by the enormous quantity and the extent of his exhibition; the fourth goes to France, considered in the light of its being the mother country of the great industry of sugars. Here, again, the needle-gun carries off the palm, and we are well beaten.

The Society of Encouragement held on Friday, the 10th inst., their second extraordinary meeting. The correspondence, summed up by MM. Tresca and Peligot, presented nothing of any interest.

M. Huzard read, in the name of M. Bells, a very favourable report on the shearing machine of M. de Nabat. For clipping horses and sheep-shearing it has been most successful. We prefer by far the little shearer of M. Cazon, which is held and set in motion by the hand, whilst that of M. Nabat is a real machine, like a knife-grinding one, set in motion by the foot.

M. Dumas read a letter, by which our friend, M. Galibert, in gratitude for the success of his respiratory apparatus, placed at the disposal of the Society of Encouragement the sum of 1000 fr., to be employed in forming a fund for the prize, for the best application of the endosmose of gases, to be awarded in 1868. This is one of the questions put forward in the programme of prizes which are most in relation with Galibert's apparatus. M. Dumas congratulated M. Galibert on his generosity, and tendered him the thanks of the Council.

M. Dumas read a second letter from M. Taborin, one of the oldest manufacturers of files, who, spontaneously on his part, and in thankfulness for his success, took upon himself to hand over 3000 francs towards the prize to be awarded in 1870 for a file-cutting machine. This mark of gratitude to the Society was most warmly applauded, and the noble veteran, much affected, rising to give thanks to M. Dumas and the council, to the great surprise of the auditory, said, "To cut files is hard work, and the Society has done well to appeal to mechanical skill for alleviating it; but the forging of them is worse again, and I beg the Society instantly to found at my expense a second prize of 3000 francs for a machine for forging files." Much moved, in his turn, M. Dumas exclaimed, "Honour to the intelligent and energetic man who commenced his industrial career forty years ago with only two and a half francs in his pocket, who has now founded three vast establishments, and who has arrived at a trade of several million francs with honour and profit."

M. Balard presented, in the name of M. Carré, his new ice-producing machine, of which we have often spoken and given a description in our report of the Academy. The principle of this machine consists of sulphuric acid marking 59° to 65°, circulating in a thin stream, through which passes vapour of water drawn along by a vacuum created pneumatically. The evaporation of this produces the cold. The recipient of the acid is formed of an alloy of lead and antimony in the proportion of 5 to 6 per cent.; it supports without alteration of form a pressure of five or six atmospheres, while the pressure in practice cannot exceed one atmosphere. The copper pump is preserved from the contact of the sulphurous acid, always disengaged by the acid recently introduced, by an arrangement which necessarily and constantly oils the inside surface. The valves are opened mechanically, and cannot get deranged. The apparatus keeps the vacuum for several months; the acid is extracted when it has become diluted to about 52°; the congelation commences generally three or four minutes after the commencement of making the vacuum; if cold water at 3° or 4° C. is required, two minutes suffice, and a little shaking up for some instants restores the air which it has lost. Other substances can be substituted for sulphuric acid (which is, however, the cheapest agent to employ), such as caustic potash or soda, or chloride of calcium, which cause a congelation sufficiently prompt and intense. In the application, M. Carré mentioned the adaptation of the apparatus on board ships and in cellars where the temperature could be indefinitely kept at 5° or 6° C. in all latitudes, also for the refrigeration of apartments.

M. Dumas is of the same opinion as M. Balard, with regard to the success of the new ice-making machine, especially if sulphuric acid can be replaced by other substances more inoffensive; he indicated that oven-dried bran, a powerful absorbent, might be tried, and requested M. Thénard to give his opinion, and to state what advantage agriculture would derive from this mode of producing cold. M. Thénard first called attention to the curious and important fact discovered by milk-women, and of which he cannot find an explanation. If milk, a few minutes after being drawn from the cow, be cooled with very cold rain-water, it keeps fresh for many days, and can be sent to a long distance. Carré's apparatus can advantageously replace the cold water, especially in agricultural distilleries, which employ a good deal of sulphuric acid and keep at the same time a great number of cows.

M. Peligot afterwards gave an account of the process of M. Paris for the fabrication of enamels, of which numerous beautiful specimens were laid before the Society. We will resume this subject further on while speaking of the Exhibition.

M. Peligot also called attention to a quite new fact that he had discovered. It arose from the devitrification of a piece of St. Gobain glass, prepared a long time ago by M. Pelouze; the glass had lost its transparency, but not its density. Placed in a drawer, the piece of glass, supported by one extremity, was found, after some days, by M. Peligot to be curved under its own weight, it having become a malleable glass; the surface was also covered

with efflorescence. Pliny speaks, in his history, of a glass that could be bent and unbent; and the story goes that Richelieu ordered an inventor to be put to death for proposing to divulge a process for making malleable glass.

M. Bouillet, in his name and that of the celebrated M. Christofle, mentions two great improvements made in their electro-metallic manufacture. 1. Round bossed galvano-plastic objects could be obtained more economically by the substitution of electrodes of lead for the insoluble platinum wire electrodes used at first by M. Lenoir, the inventor of the process. 2. A series of pieces in bronze, decorated with inlaid work in silver, platinum, and yellow or green gold, had been obtained by electricity, and which perfectly imitated the charming objects coming from China or Japan. F. Moigno.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Group V.—Class 44: Chemical and Pharmaceutical Products.

(*Continued from page 236.*)

The glass case of Messrs. John Casthelaz and Co., of Paris, contains a very rich collection of chemical products obtained by newly improved processes, which reflect great credit on the firm. We shall enumerate them rapidly. They decompose daily two tons of nitrate of soda by sulphuric acid to obtain either nitric acid, monohydrated nitric acid of 48° to 50°, or pentahydrated from 36° to 40°. Nearly all these acids are employed on the very spot where they are produced. The monohydrated acid serves to produce the nitrated products of benzol and toluol; the acid at 35° is used to transform arsenious into arsenic acid, phenic acid into trinitro-phenic or picric acid, the bichloride of naphthaline into phthalic acid, &c. They transform daily a ton of benzol into nitrobenzol and aniline, and fabricate, on a very large scale, picric acid, crystallised and fused. The weight of some of the specimens attains one or even two kilogrammes. They have invented also, for purchasers, an apparatus termed *picrometer*, which permits them to verify, without trouble, the purity of the acid delivered. Starting with the fact, noticed by MM. Paris and Ernest Depouilly, that the basic phthalate of sulphate of lime at 300° is changed into benzoate of lime, they make naphthaline serve for the production of benzoic acid. Phthalic acid results from the decomposition of the naphthalic bichloride. Phthalate of ammonia distilled gives phthalimide of lucuine; distilled with powdered quicklime, the phthalimide produces benzonitrile, and benzonitrile distilled with caustic soda gives benzoate of soda, from which chlorhydric acid precipitates benzoic acid. Attacked by nitric acid, the bichloride of naphthaline leads to an oil, and forms binitrated chloride or the binitro-chloroform of M. Berthelot, of which the odour is so penetrating, and the action on the eyes and respiratory organs so terribly deleterious. The small vial of this oil which figures in the above-named glass case contains enough to burn the eyes of thousands of visitors. Near it we see the picrates of baryta, iron, lead, and mercury; chloroxynaphthalates of baryta, iron, zinc, nickel, and copper; with the bichromate of potash aniline violets, the soluble garnet colour, isopurpicrate of potash, a fulminating substance which must be kept wetted with water, the product of the reaction of cyanide of potassium on picric acid, which dyes wool in the richest colours with a saving of 25 per cent.

The pure and crystallised products from the laboratory of Messrs. Coblentz Brothers — phenotoluol, azobenzol, nitranilines, binitrobenzol, binitrotoluol, toluyldiamine, and paraniline—do them the highest honour. They are eminently skilful in transforming into colouring matters the direct products of coal tar. They exhibit an enormous block of nitrotoluol admirably well crystallised, of a pale yellow colour, and nearly free from nitrobenzol. They have discovered a very cheap process for transforming nitrobenzol into aniline, and nitrotoluol into toluidine. They take cast-iron turnings, roughly ground to powder, cover them with a layer of metallic copper, by plunging them in a solution of sulphate of copper. These galvanised turnings are then placed along with nearly an equal quantity of non-galvanised turnings, and surrounded by a sufficient quantity of water. Nitrobenzol or nitrotoluol is then added, and a galvanic action takes place in the liquid. The water is decomposed, and the hydrogen makes the nitrate body pass into the state of aniline or toluidine, which is then rectified and rendered pure. By treating the residues with sulphuric acid, the copper is dissolved, and can serve for another operation.

A magnificent and curious experiment will be made in a few days in the middle of the Exhibition, in the portion allotted to M. Flaud, one of the constructors admitted to furnish motive power for the gallery of machines. The experiment is imagined and organised by M. Henry Giffard, the well-known inventor of the injector; but it is to be produced under the name of Mr. Young, formerly the companion of M. Giffard in his steam essay of aërial navigation. It will consist of an anchored balloon, which will rise with twenty or twenty-five persons to a height of about a hundred metres. It will remain some time in the air, and then descend, to ascend again with a fresh party, and so on all day long. The problem of captive aërostation is, it is well known, one of the most difficult of physical mechanics. Arago said it was almost impossible. M. Giffard solves the question on the most rational side, and he will succeed. His balloon is a perfect sphere 21 metres in diameter, formed of two very fine and close tissues stuck together with several coats of black india-rubber American varnish, coated also with linseed drying oil to prevent all osmose or diffusion. This cloth is sufficiently impermeable to hydrogen to keep it in for a time sufficient for prolonged experiments, even for a whole day. The dimensions of the balloon are calculated so as to assure an ascensional power in such a manner that the horizontal component of the wind will only produce a slight deviation in the vertical direction of the cable holding the balloon. Upon this depends all the successful solution of M. Giffard, and it is certain that the angle of deviation will never exceed 40°. The cable unrolls and rolls up on a drum-wheel very solidly fixed. The hydrogen for the balloon will be temporarily procured by the ordinary process—iron and sulphuric acid; but in a few weeks it will be obtained by the decomposition of water by red-hot charcoal, at a price less than 15 c. the cubic metre. Oxygen of M. Tessié de Mothay at 50 c., and Giffard's hydrogen at 15 c. the cubic metre! What a fortunate combination this will make for the use of many industries!

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, April 16, 1867.

Edward Schunck, *Ph.D., F.R.S., &c., President, in the Chair.*

Mr. Henry Charles Beasley was elected an ordinary member of the Society.

"*On a New Form of the Dynamic Method for Measuring the Magnetic Dip*," by Sir William Thomson, M.A., D.C.L., F.R.S., &c., Honorary Member of the Society.

Seven years ago an apparatus was constructed for the natural philosophy class of the University of Glasgow, for illustrating the induction of electric currents by the motion of a conductor across the lines of terrestrial magnetic force. This instrument consisted of a large circular coil of many

turns of fine copper wire, made to rotate by wheel work about an axis, which can be set to positions inclined at all angles to the vertical. A fixed circle parallel to the plane containing these positions, measured the angles between them. The ends of the coil were connected with fixed electrodes, so adjusted as to reverse the connexions every time the plane of the coil passes through the position perpendicular to that plane. When in use, the instrument should be set as nearly as may be in the magnetic meridian. The fixed electrodes being joined to the two ends of a coil of a delicate galvanometer, a large deflection is observed when the axis of rotation forms any considerable angle with the line of magnetic dip. On first trying the instrument I perceived that its sensibility was such as to promise an extremely sensitive means for measuring the dip. Accordingly, soon after I had a small and more portable instrument constructed for this special purpose; but up to this time I had not given it any sufficient trial. On the occasion of a recent visit, Dr. Joule assisted at some experiments with this instrument. The results have convinced us both that it will be quite practicable to improve it so that it may serve for a determination of the dip within a minute of angle. I hope, accordingly, before long to be able to communicate some decisive results to the Society, and to describe a convenient instrument which may be practically useful for the observation of this element.

"*Observations on the Alteration of the Freezing Point in Thermometers*," by Dr. J. P. Joule, F.R.S., V.P.

Having had in my possession, and in frequent use, for nearly a quarter of a century, two thermometers, of which I have from time to time taken the freezing points, I think the results may offer some interest to the Society. Both thermometers are graduated on the stem, and are, I believe, the first in this country which were accurately calibrated. Thirteen divisions of one of them correspond to one degree Fahrenheit. It was made by Mr. Dancer, in the winter of 1843-44. My first observation of its freezing point was made in April, 1844. Calling this zero, my successive observations have given

0	April, 1844.
5·5	February, 1846.
6·6	January, 1848.
6·9	April, 1848.
8·8	February, 1853.
9·5	April, 1856.
11·1	December, 1860.
11·8	March, 1867.

The total rise has been, therefore, ·91 of a degree Fahrenheit. The other thermometer is not so sensitive, having less than four divisions to the degree. The total rise of its freezing point has been only ·6 of a degree; but this is probably owing to the time which elapsed between its construction and the first observation being rather greater than in the case of the other thermometer. The rise of the two thermometers has been almost identical during the last nineteen years.

"*On the Casting, Grinding, and Polishing of Specula for Reflecting Telescopes, Part IV.*;" by James Nasmyth, Esq., C.E., Corresponding Member of the Society.

In this part of his paper the author gives detailed descriptions, illustrated by diagrams, of his methods of mounting the specula of reflecting telescopes, and of testing the figure of the great speculum; he also offers some very useful remarks on the general management of Newtonian reflecting telescopes, and on the atmospherical circumstances which affect their performance.

PHOTOGRAPHICAL SECTION.

April 9, 1867.

J. Baxendell, *F.R.A.S., Vice-President of the Section, in the Chair.*

Mr. Brothers read the following "*Note on Photography in* 1787."

It is generally supposed that the earlier attempts to use nitrate of silver for producing pictures of lace, leaves, and other objects on white leather or paper were made by Wedgewood and Davy about the year 1802; but it will appear from the following extract that at least fifteen years earlier than the date named, and within ten years of the time when Scheele investigated the subject of the action of light on the salts of silver, the possibility of utilising the action of light was known. The title of the book from which the extract is taken is "Rational Recreations in Natural Philosophy," &c., by W. Hooper, M.D., 1787; and the paragraph is headed "How to print letters by sunlight."

"Dissolve chalk in aqua fortis to the consistence of milk, and add to that a strong dissolution of silver. Keep this liquor in a glass decanter well stopped, then cut out from a paper the letters you would have appear and paste the paper on the decanter, which you are to place in the sun in such a manner that its rays may pass through the places cut out of the paper and fall on the surface of the liquor. The part of the glass through which the rays pass will turn black, while that under the paper will remain white. You must observe not to move the bottle during the time of the operation."

Mr. Coote exhibited some snow scenes, the negatives of which were taken on collodio-albumen plates. Some of these beautiful views were slightly defective in the high lights, a number of vein-like markings appearing in the sky and foreground.

Mr. Wardley stated that these defects were entirely caused in the development, and had no connexion with the character of the collodion used, or with the preparation of the plate. He considered that the imperfections were produced entirely by the repellent or nonmiscible nature of the solutions, containing acids and salts, used in development, acetic acid being one of the chief causes of the defects. Another source of the evil may be a low temperature and the developing solution being allowed to rest, even for a moment, on the plate. Such defects may be produced in abundance on any kind of dry plate if the developing solution is allowed to rest.

ACADEMY OF SCIENCES.

May 13, 1867.

(From our Special Correspondent.)

Dr. Nelaton begged the Academy to inscribe his name among the list of candidates for the vacant chair in the medical and surgical section, by the death of M. Jobert de Lamballe. Is he not rather late in the field—when, during all his life, he was no more interested in the Academy than if it never existed; and when he never made his appearance but once, to read a work made in collaboration with a young recruit? He must have depended upon the little respect paid by the Academy, sometimes, to itself, to offer himself as a candidate in such an unprepared manner. For my part, I shall not give my vote to M. Nelaton, first-rate surgeon though he be among us.

M. Boussingault communicated a new series of researches relative to the deleterious influence exerted by the vapour of mercury on the vitality of plants. He has repeated and modified the very curious experiments made by some Dutch *savants* in 1797. They placed under a bell glass a plant, with a small vessel containing mercury, and they found that, at the end of a few days, or even a few hours, the leaves of the plant were spotted and blackened, and that it ultimately perished. But when they fixed a small piece of sulphur on the inside surface of the bell glass, the deleterious action of the mercury ceased, and the plant remained healthy. It was not difficult for M. Boussingault to assure himself, by a series of careful observations, that the mercurial vapours had a sort of elective affinity for the sulphur—that sulphuret of mercury

was formed, which is inoffensive. M. Boussingault has varied his experiments relative to the action of vapours on plants and the precious metals, silver and gold. He has measured their tension, and appreciated their action on the colours and weight, &c. M. Regnault thinks that the best reagent against the vapours of mercury is an iodised daguerreotype plate ready to be coated and exposed to the light. M. Boussingault maintains that the sensibility of the plates is nothing as compared with that of plants.

M. Pictie, of Geneva, was then elected as member of the Section of Anatomy and Physiology, by forty-two votes against one, given to M. Sace, of Neufchatel.

M. Becquerel, the elder, communicated his series of experiments on the influence of the capillary action of surfaces upon decomposition and chemical combination. He takes a tube with two branches reversed, and makes in it a fissure, the width of which is infinitely small. He pours therein a solution of nitrate of copper, and has found that no liquid passes by the fissure; but when placed in a vessel containing liquid protosulphuret of sodium, an electrical action takes place, and decomposition and recomposition ensue, manifested by the crystals which appear on both sides of the fissure. M. Becquerel has demonstrated the new and curious phenomenon that the capillarity of the fissure has a real influence on the nature of the products of the decomposition; that the salts or the crystallisations are not always those indicated by theory; that the double decomposition often goes to the extent of reduction of the metal.

M. Elie de Beaumont presented, in the name of M. Civiale, an immense collection of urinary calculi, arranged according to their form and structure, composition, &c. He read a long note, giving details of each group.

M. Ch. Sainte-Claire Deville recounted his studies "*On the Periodical Variations of Temperature.*"

The author has established, in one of his former memoirs, that there exists a certain depending connexion in the movement of the mean temperature of four days, placed on the ecliptic at an angle of 90° one from the other, for the four months, opposed two by two, of February, May, August, and November, which contain the critical days, known by the ancients under the name of the *three saints of ice* (May 11, 12, 13), and the *summer of Saint Martin* (November 11). In this new work he shows that the fact is general, and that this connexion or mutual dependence of the four opposite days exists during the whole of the year; whether we take into consideration a considerable cycle —110 years at Berlin, 90 years at Vienna, 50 at London, 40 at Prague and Edinburgh, 30 at Brussels, 24 at Toulouse, 21 at Paris—or that we take in this point of view an isolated year (1864) on several European stations.

The former, depending upon the same data, establishes, in fine, that this connexion is evident also when we combine twelve by twelve the days separated one from the other by 30° of the ecliptic.

The latter phenomenon constitutes the *meteorological month*, as the *season* was established by the consideration of the quadruple days.

M. Marié-Davy presented his ninth memoir "*On the Mechanical Theory of Electricity.*" The *résumé* that we shall shortly publish is a sort of synthesis of the principal phenomena of nature. These are his conclusions:—In a ray of light the vibrations are not in the direction of the wave. In a hot substance, in which μ varies symmetrically all round each material centre, the vibrations take place generally in the same manner on the three axes. In the circuit in activity the electric vibration takes place in the direction of the propagation of the current, and the *vis viva* set at liberty by the chemical action passes along that channel. But light, heat, and electricity have the same *vis viva*, having the same mechanical equivalent.

In this hypothesis of the vibrations, the positive electricity is ether condensed in excess; negative electricity is ether in deficiency. It is a long time ago that we sustained this theory, on which we made a memoir presented to the Academy in 1845. Baron Sequier, in the name of M. Stamm, of Milan, communicated the plan of an association between a horse and a steam motor, inspired by a lecture that he gave last year before the Academy, and in which he drew such a clear comparison between inanimate motors and animate ones working by their own will. M. Stamm, in his vehicle with a steam engine commanded by a horse, has so disposed it that the horse gears the machinery when in motion, and ungears it when he stops; so that he arranges the valves in a manner that, when backing, the steam is reversed, and the intelligence which the machinery wants is supplied by the horse.

NOTICES OF BOOKS.

On the Poisons of the Spreading Diseases. By B. W. Richardson, M.A., M.D., F.R.S. London: John Churchill and Sons, New Burlington Street. 1867.

This reprint of the famous lecture delivered at the Leamington Congress last year, will give some satisfaction, and almost as much disappointment. The satisfaction will be derivable from the many forcible truths and collection of facts, the disappointment caused by their admixture with so much that is mere statement, sometimes almost dogmatic.

Every reader of the book will find this to be a difficulty, for it will be necessary for him to winnow, we will not say the grain from the chaff, but the more healthy corn from the other grains mixed with it.

Although opposed from principle to the practice of ladies attending sanitary congresses and interesting themselves in the details of sewage, we find from the present case that fewer evils than we supposed were without an attending good; for the reflection that the Congress would be of a miscellaneous character, "at which perhaps ladies might be present as well as gentlemen," has been the cause of the selection of the subject of this paper—a paper we honestly think of very great value in much of its substance.

The form that we should like to see this valuable matter assume, would be that of detailed experiments given, and after this the author's deductions from them. The one would remain as valuable staple matter of reference; as regards the latter, a verdict might be given by every reader. There is no doubt that Dr. Richardson has found entirely satisfactory evidence of everything that he asserts; but every thoughtful reader must decline to record a similar conviction for himself in the absence of the evidence.

We have fifteen diseases given arbitrarily as those produced by *organic* poisons, organic being used in a sense of its own. Thus strychnine would not be an organic poison; it is not asserted, however, that it is an inorganic one. In this list small-pox appears as produced by organic poison, boil and carbuncle with infectious ophthalmia (*Ophthal. Egyptorum?*), but chicken-pox, cow-pox, dysentery, are excluded. Typhus appears in the list, and very strong evidence has been tendered of the connexion of dysentery with typhus, and cases, with no apparent fallacy, have been recorded of epidemic dysentery brought from India on board ship causing a typhus outbreak in port by direct infection. Such facts ought not to be ignored in a critical examination of which every step is attended with difficulty. And thus on almost every page the eye is arrested by some very knotty question comfortably disposed of. This renders a detailed criticism a work of almost indefinite length.

To choose a few sentences at random. "Each poison has a specific property always bringing out the same disease through countless ages. All are destroyed by oxidising agents. . . . Exposure to nitrous acid has the same

kind of effect; exposure to sulphurous acid likewise produces destruction."- "Common sulphur preserves them very well; the poison of hospital fever I have been able to preserve for months by this means." (Query: What means?) "The poisons will all dry solid. There is no exception to this rule." (Query: Who has examined this?) "Sulphur, creasote, and arsenic hold these organic poisons in perfect steadiness; they preserve their active properties."

All these quotations require support from experiments, original or otherwise, for any judgment to be formed. Again, "There is reason to believe that in the decomposition of sewage water cholera poison may be developed." These quotations are all from two or three consecutive pages, and are accompanied by many others of the kind.

Is our demand for a detail of experiments then unjustifiable? If these are not forthcoming, England must yield the palm to America; for Dr. Richardson quotes some experiments that are convincing.

"During the great American struggle, Dr. Salisbury observed that a large number of men rose one morning with symptoms of measles. . . . The men attributed their illness to the straw upon which they lay. . . . Dr. Salisbury removed from the straw certain portions of fungus; he had the courage to inoculate himself with the fungus, and he thus produced measles. He then inoculated *his own wife*, and then *a mother and four children*, then a mother and two children, and produced in all the same disease." We must leave the reader to judge of the feelings of the ladies present at this great sanitary congress.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Poggendorff's Annalen. February 11, 1867.

C. G. Junge: "*Remarks on the Diffusion of Steam through Dry Atmospheric Air and on some other Hygroscopic Phenomena.*"—E. Zettnow: "*Researches on Wolfram and its Compounds.*"—P. Kremers "*On the relative Volume of Compounds of the First Degree.*"—J. Muller "*On the Focal Length of Lenses;*" "*On the Fluorescence Spectrum of the Electric Light.*"—W. Holtz "*On the Production of the Electric Spark in Glass, with especial Reference to the Electrical Machine;*" "*On the Theory of the Construction of Electrical Induction Machines.*"—A. Brezina "*On the Use of the Stauroscope.*"—F. Lindig: "*A Reply to H. Schiff's Paper on Supersaturated Solutions.*"—C. Rammelsberg "*On the Composition of Franklinite.*"—Arndt "*On Nägeli and Schwendener's Method of Calculating the Magnifying Power of Microscopes.*"—W. Schmidt "*On a new Metallic Thermometer.*"

Journal des Fabricants de Papier. February 15, 1867.

E. Bourdilliat "*On Testing the Chemical Products used in Paper Making (Continuation).*"—J. Mauslay "*On the Preparation of Chlorine.*"

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

659. W. R. Lake, Southampton Buildings, Chancery Lane, "An improved mode of coating paper and other materials with fluid substances, solutions, and compounds for photographic and other purposes." A communication from J. C. Crossman, Boston, Mass., U.S.A.—Petition recorded March 8, 1867.

1042. W. Henderson, Glasgow, "Improvements in oxidising minerals, ores, and metals; in reducing oxides of metals; in separating certain metals from each other; in kilns, furnaces, or other apparatus for these purposes; and in the treatment of the products obtained therefrom."—April 6, 1867.

1087. W. H. Dawes, West Bromwich, Stafford, "An improvement or improvements in the manufacture of iron."

1091. C. Wilmet, Brussels, "An accelerated tanning by means of new processes and apparatus."—April 12, 1867.

1099. J. Aitken, Tottington Higher End, Lancashire, "Certain improvements in apparatus employed in the process of refining sugar."

Notices to Proceed.

3307. C. E. Brooman, Fleet Street, "Improvements in the preparation and application of certain fatty bodies." A communication from M. P. Javal and E. P. Javal, Paris.—Petition recorded December 15, 1866.

22. W. Knaggs, Euston Grove, Euston Square, Middlesex, "Improvements in apparatus for evaporating and boiling saccharine liquors."—January 3, 1867.

47. W. Way, M.D., Eliot Place, Blackheath, Kent, "Improvements in preparing phosphatic minerals for use as manure." Partly a communication from C. Henwood, Sombrero, West Indies.—January 7, 1867.

250. E. V. L. Ebersburg, Knightsbridge, Middlesex, "A new or improved article of food for infants and invalids." Partly a communication from Baron J. von Liebig, Munich, Bavaria, Germany.—January 30, 1867.

819. J. Greenshields, Glasgow, N.B., "An improved compound or combination of materials to be used for the production of illuminating gas."—March 21, 1867.

CORRESPONDENCE.

The Chemical Society.

To the Editor of the Chemical News.

Sir,—Your leading article in the Chemical News of Saturday last interested me. I have long been expecting to see evil effects arise from the admission of so many persons into the Chemical Society who are manifestly unworthy of that honour. I mean persons who simply pay the fees, and do not promote chemistry either by original communications, or in any other way worthy of the title F.C.S. The followng circumstance may perhaps interest you, as it relates to this subject:—A junior partner in a manufacturing firm was admitted into the Chemical Society; on being asked what chemical investigations he had made to entitle him to that honour, he replied that other persons made investigations besides those who published them, meaning thereby that he had made chemical investigations, but did not publish them. The objects of the Chemical Society are defined to be "the promotion of chemistry, and of those branches of science immediately connected with it, by the reading, discussion, and subsequent publication of original communications." The admission, therefore, into the Society of persons whose practice (as in the above instance) is to monopolise chemical knowledge, and keep it secret for their own personal advantage only, is contrary to the objects for which the Society exists; it is also conferring an honour upon persons who do not adequately deserve it. Further, the admission of persons whose only object is to promote their trades, and the getting of money by them (however worthy those objects are in themselves), is unjust towards those members who, at considerable sacrifice and much self-denial, aid in the extension of chemical knowledge. I am, &c.

F.R.S., F.C.S.

Caramel Colours.

To the Editor of the Chemical News.

Sir,—Under the "Notes and Queries" in your valuable paper (No. 387), I happen to find one concerning caramel. Perhaps the following may be of use to your correspondent.

The manufacture of caramel (coffee finings, as it is often termed in London) is kept a secret on this account, that neither coffee-roasters, nor dealers in groceries, nor brewers, may have, or at least are presumed not to have, any in their possession—the Excise prohibiting it. Here in London it is made by roasting sugar of coarse description in cylinders similar to those used for roasting coffee, chicory, and cocoa; this yields a very inferior preparation both for colouring as well as for admixture with coffee. So prepared it contains assamar and other pyrogenetic products which are very bitter. On the Continent apples of inferior description are treated as described, yielding a product superior to that obtained from sugar. Sugar, however, is the only fit material to prepare caramel, and for this purpose the sugar is best heated in capacious roomy vessels made of copper (in Vienna copper lined with silver is preferred), the vessel containing the sugar being placed in an oil bath* containing a thermometer to indicate the temperature. The latter must not be below 410° nor above 428° Fahr. The heating of the sugar is continued as long as aqueous vapours are given off. The crude caramel so obtained is best purified by being placed upon a parchment paper dialyser, which is placed on water. The undecomposed sugar and intermediate compounds are thus got rid of; they dissolve out with facility, and what remains on the filter is, weight for weight, five times as strong in colouring matter as the crude caramel. While the sugar is being exposed to heat it is preferable to stir it with a spatula.

Another mode of obtaining a pure caramel, free from bitter produce (assamar and the like), is to heat the sugar as above, and to treat the powdered caramel with alcohol (pure methylated spirits), to digest it for three to four hours therewith, and repeat this till all bitter taste is gone. An aqueous solution containing 10 per cent. of purified caramel is gummy, and forms a jelly. When a solution of caramel in water is evaporated *in vacuo* (small vacuum pan as used in sugar refineries), it dries up to a black shining mass, freely soluble again in water, hot or cold; but if the solution is evaporated on a waterbath to dryness in contact with air, the whole mass becomes insoluble in water either hot or cold.

A very small proportion of caramel gives to a large bulk of water the dark brown tinge known as sepia. An impure but pretty strong solution of crude caramel (*i.e.*, not purified by dialysis or alcohol—hence the term impure for the solution) is sold in London under the name of Coffeena in small bottles at 1s. per bottle, to be had in many oil and colour shops in the metropolis; it is used in teaspoonfuls to improve coffee, dispensing with chicory.

I am, &c. A. Adriani.

London, May 7.

P.S.—Treacle is not very manageable to use for the making of caramel. The sugars should be first dried at 212° Fahr. On the Continent dry glucose is sometimes used instead of cane or beetroot sugar for the purpose of making caramel.

Obituary.—It is with regret that we announce the death of Mr. Hippolyte Baillière, the well-known scientific publisher, which took place on Saturday last at his residence, 219, Regent Street. Mr. Baillière's illness has been long and painful, and for some time past his sons have taken a very active part in the practical management of the business. The late Mr. Baillière's energy and talents have caused his name to be known and respected in many of the capitals of Europe and America.

* A mixture of tin and lead is sometimes used, just made so as to remain fluid at from 412° to 430° Fahr.; some bismuth is added.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Aromatic Monamines give rise to Acids richer in Carbon.—A. W. Hofmann. The principal product obtained by distilling one molecule of oxalic acid with two molecules of aniline is phenylformamide, but secondary actions give rise in addition to carbonic dioxide; from the proportions one molecule of oxalic acid and one molecule of aniline, a crude product was distilled containing cyanhydric acid; heated with concentrated chlorhydric acid, and distilled, this crude distillate gave off with the steam an oily body of aromatic odour, which, when boiled with solution of soda, partly dissolved with disengagement of ammonia (resulting from decomposition of diphenylamine); the addition of chlorhydric acid to the alkaline solution produced a precipitate of benzoic acid, the argentic salt analysed, showing that the oily liquid with aromatic odour contained benzonitrile. This body evidently results from splitting of phenylformamide into water and benzonitrile.

The production in an analogous reaction of toluylic acid from toluidine, and of a superbly crystalline acid, $C_{11}H_8O_2$, from naphthylamine, proves the generality of the reaction. —(*Comptes R.* lxiv. 387.)

Reactions, General Conditions of.—M. Berthelot considers that a chemical reaction which is capable of setting free a notable quantity of heat will necessarily and directly occur whenever the following conditions exist:—1. The reaction is one which reaches its limit within a very short time from its commencement; this condition is fundamental. 2. The reaction is one which begins without foreign aid at the temperature of the commencement of the experiment; reactions excluded by this condition act in conformity with the principle enunciated, if they are caused to set in, either by raising the temperature or by other means. 3. The parent substances and the products possess similar functions. He is of opinion that the inverse reactions of iodhydric acid and argentic chloride might be foreseen from the basis of this general principle, and that the analogous action of iodhydric acid on potassic chloride, which he has experimentally verified, is a further proof of the correctness of his view.—(*Comptes R.* lxiv. 413.)

Glass.—L. Clemandot. A sample of glass was made from silica and soda, free from lime, the silica being greatly in excess; after fusion at a very high temperature, and while fusing, a portion was taken out; this portion has remained perfectly unaltered; the remainder, after slow cooling in the crucible, became devitrified. Excess in the proportion of any one ingredient is likely to render glass devitrifiable. The most stable glass is that one which is most complex in composition—that is, which contains the greatest number of bases.—(*Comptes R.* lxiv. 415.)

Colours from Coal-tar (C = 6).—De Laire, Girard, and Chapoteaut. If, in preparing violaniline (3 molecules of aniline conjoined with elimination of H_6), aniline containing toluidine be used, the product is contaminated with a small quantity of rosaniline, and a larger proportion of mauvaniline—

$$\left.\begin{matrix} C_{12}H_4,H \\ C_{12}H_4,H \\ C_{14}H_4,H \end{matrix}\right\} N_3,HO,$$

a base possessing remarkable tinctorial properties. Its formula is substantiated—1st. By its formation by appropriate oxidation of a mixture of aniline and toluidine containing a greater proportion of the former. 2nd. By simultaneous formation of water. 3rd. By the replacement in its molecule of H_3 by methyl, ethyl, phenyl. 4th. By its decomposition on distillation into the primary and secondary monamines of the phenylic and toluylic radicals. It is derived from two molecules of aniline and one molecule of toluidine, H_6 being eliminated; it is crystallisable; retains HO even after several hours' exposure to 120—130°, but loses it at a higher temperature; it is

soluble in ether, benzol, and alcohol; insoluble in cold, sparingly so in boiling water; it forms crystallisable salts with acids; the acetate and chlorhydrate are especially fine bodies; the salts are slightly soluble in cold water, rather soluble in boiling water. Triphenylomauvaniline is obtained by acting upon mauvaniline with aniline; it is a crystallisable base, soluble in ether and alcohol, insoluble in water; its salts form splendid blue dyes.

Violaniline, mauvaniline, rosaniline, and chrysotoluidine (derived from the conjunction of three molecules of toluidine, H_6 being eliminated) are the first four consecutive terms of a series having a common difference C_2H_2.—(*Comptes R.* lxiv. 416.)

Retene: its Constitution (C = 6).—M. Berthelot. Retene $C_{36}H_{18}$ is distinguishable from naphthalene, which it resembles in aspect by its having no odour, by its lesser solubility in alcohol, and by its melting at 95°; it boils at about 400°; the vapour, mixed with hydrogen and passed through a red-hot tube, decomposes, producing large quantities of anthracene, carbon, acetylene, and some gaseous hydrocarbons, one of which is absorbed by monohydrated sulphuric acid. Yielding, under these conditions, anthracene, from which it differs by $4C_2H_2$, it cannot be derived from benzol, although its formula is triple that of benzol, but it might be derived from benzol and a hydrocarbon such as ethylene or formene, capable of supplying the acetylene necessary for the production of anthracene, its lower homologue. Attempts to obtain it from cumol in a reaction similar to that which gives anthracene from toluol have not been successful. The first members of the homologous series commencing with anthracene, and including retene, will probably be found among the solid hydrocarbons which crystallise immediately after naphthalene in the heavy oil of coal-tar.—(*Bull. Soc. Chim. Paris*, 1867, 231.)

Xylol, Chloro-derivatives of (C = 12).—C. Lauth and E. Grimaux. Xylol (distilling entirely between 137° and 139°) vapour and chlorine gave a liquid from which a fraction collected between 190—195° precipitated cold argentic nitrate solution; boiled with argentic acetate, a liquid of agreeable odour, probably tolylic acetate, was formed; boiled with plumbic nitrate solution, a liquid having an odour resembling bitter almond oil, combining with sodic disulphite, and boiling at 200°, was produced, evidently C_8H_8O tolylic aldehyde. Therefore, in the first-mentioned reaction a change occurs analogous to that by which benzylic chloride is produced from toluol, and the chlorxylol obtained should be represented by

$$C_6H_4 \begin{cases} CH_2Cl \\ CH_3 \end{cases}$$

The fractions distilling between 230—260° contained $C_8H_8Cl_2$, a crystalline body, but in smaller quantity than was necessary for the study of its reactions; it melts at 100°. It is proposed to extend this reaction to trimethylphenyl, cumol from coal-tar, the alcohol $C_9H_{12}O$ being at present unknown.—(*Bull. Soc. Chim. Paris*, 1867, 233.)

Alizarin.—C. Koechlin. The colouring matter from madder, after sublimation or exposure to 280°, no longer gives the tints sought by dyers; a yellow tint is wanting, in searching for which the author is engaged with Schützenberger.—(*Bull. Soc. Chim. Paris*, 1867, 235.)

Benzolsulphurous Acid (C = 12).—R. Otto and H. Ostrop. Benzolsulphurous chloride, $C_6H_5ClSO_2$, most carefully dried, was diluted with ether perfectly free from alcohol and water; sodium amalgam was added by small portions till a sample of the fluid, after expulsion of the ether, dissolved in water; the ether was then expelled, and a small quantity of water was added; the aqueous solution was separated from an oily body, and mixed with chlorhydric acid; the crystals which formed were recrystallised from hot water, and about two-thirds the theoretical quantity of benzolsulphurous acid was obtained. Its properties were the same as described by its discoverer, Kalle, who made it from zincic ethide and benzolsulphurous chloride. With fuming nitric acid benzolsulphurous acid gave $C_{18}H_{16}N_2S_3O_6$, for the unravelling of the constitution of which material was wanting; nitrobenzolsulphuric acid $C_6H_5(NO_2)SO_3$, was also formed. With bromine, benzolsulphurous bromide was produced, C_6H_5,SO_2,Br, and not brombenzolsulphurous acid, C_6H_4Br,SO_2,H, for ammonia gives with it an amide, and not ammonic brombenzolsulphite. With phosphoric pentachloride, benzolsulphurous chloride, and a body probably $C_{12}H_{10}S_2O_3$, separated from the former by dilute solution of potash, were obtained. The oily body formed in the first reaction, and toluol- and xylol-sulphurous acids, will form the subjects of future communications.—(*Ann. Chem. Pharm.* cxli. 365.)

Valerylene, Polymers of (C = 12).—E. Reboul. Concentrated sulphuric acid acts violently on valerylene; no conjugated acid is formed. A fraction of the product between 175—177° was divalerylenic hydrate, $2C_5H_8,H_2O$. The fraction between 265—275°, sp. gr. 0·862, at 15°, was trivalerylene, $(C_5H_8)_3$. The distillate between 280—350°, in which interval the thermometer rises continuously, as also the residue, which, on cooling, solidified to a semi-transparent mass, is a mixture of polymers of different degrees of condensation. Sulphuric acid diluted with one or one-third volume of water produces the same results, but more slowly, and consequently with less violence.—(*Comptes R.* lxiv. 419.)

MISCELLANEOUS.

Conversazione at the Pharmaceutical Society.—The annual gathering of the members of this Society and their friends took place on the evening of Tuesday last. The attendance was very numerous, and included several visitors distinguished in various branches of science. During the evening Mr. Baines gave a descriptive lecture on his geographical and ethnological explorations in the interior of Africa, profusely illustrated with photographs and transparencies, which were projected on a screen from a magic lantern. The objects of interest to chemists were very numerous, and amongst other novelties included large masses of fused and forged platinum, magnesium in various forms, and pure hydrate of sodium, by Messrs. Johnson and Matthey; Mr. Beane's valuable ozone generator exhibited at work, as used for the decolorisation of sugar, by Mr. Ladd; Professor Wheatstone's magneto-electric machine; specimens of the new porcelain standard yard and metre, as adopted by the International Association for obtaining a uniform decimal system of measures, weights, and coins, exhibited by Mr. Casella; and a new form of gas-engine, and a new hot-air engine. These last two are sufficiently interesting to deserve a more extended notice. The gas-engine is the invention of M. P. Hugon, and is the first we have seen that requires no electricity. This engine may be worked the whole day without any supervision whatever, and requires nothing but turning on and lighting the gas to set it in full work. When once started it may be locked up and left going day and night without stopping. There is so little danger from its use that its presence does not affect insurance. The expense of the power is said to be about one halfpenny per man per hour, and, used in this form, the employer possesses the advantage of discharging the labour at any moment, and of only paying for it whilst actually required.

The hot-air engine is based upon the fact, long known to scientific engineers, that the most economical mode of obtaining power from heat is by its direct application to the expansion of air, or other permanent gases, rather than by that of steam or any other vapour. The hot-air engine now described differs from the so-called "caloric engines" in several essential particulars as to its construction, so that it is free from those defects which have hitherto pre-

vented the practical carrying out of the caloric theory. In this engine the motive power, instead of being derived from the expansion of air heated in a separate generator, as in former engines, is produced by the expansion of air heated by contact with the fuel itself, and, in addition to this source of the power, by the action of the expansive force of the gaseous products of the combustion of the fuel, which heretofore have been permitted to escape into the chimney without being in any way utilised in the production of power. This result is accomplished by placing the fuel in a grate which can be hermetically closed, and forcing the air required for combustion into it by means of an air-pump worked by the engine itself, so that no part of the heated air of the gases produced by the combustion of the fuel can escape without passing through the cylinder, and there doing duty in the production of force. It is obvious that by such an arrangement the employment of separate iron generators for the purpose of heating the air is dispensed with, and that thereby one of the chief difficulties of the old caloric engine is avoided; for in the hot-air engine the fuel is contained in a fire-clay furnace surrounded by an air-tight iron casing, which in this way is entirely protected from injury. The fuel, which may be anthracite, smokeless coal, or coke, is thus burned under pressure with great regularity, and with the production of a uniform temperature, and at a rate exactly proportionate to the duty the engine is called upon to perform, thus avoiding all waste of fuel—a result which has not been attained with any form of engine yet introduced.

The heated air, together with the gases produced by the combustion of the fuel, pass from the fire-box directly into the cylinder, so that every unit of heat produced is converted into force. The piston consists of a hollow plunger, to which the piston-rod is attached; the packing is placed around its upper circumference, where the heat is so moderate as to permit of efficient packing and lubrication. By means of an air-pump worked by the piston, a supply of air is forced into the grate. It here comes in contact with the fire, and a portion of it, in maintaining combustion, combines with the carbon, producing carbonic acid, &c. ;while another portion of the air in excess takes up heat, and is thereby expanded. The mixed heated air and gaseous products of combustion speedily accumulate such an amount of expansive force as to set the engine in motion, by pressing on the piston. At the end of the stroke the expanded gases escape by the waste-pipe, which may be connected by a common stove-pipe with an ordinary chimney. Each upward stroke of the piston produces a downward corresponding stroke of the air-pump, and forces a fresh charge of cold air into the grate to maintain the combustion of the fuel, thus keeping up a continual supply of heated air and gaseous products. The power is increased or diminished by dampers, which pass the air through or over the fire, according to the amount required.

The chief advantages of the hot-air engine will be found in the very important facts, that there is not the most remote danger in its use. The furnace is perfectly insulated, so that all risk of fire is entirely avoided, and the presence of water, whether in large or small quantity, is dispensed with; so that this engine can be employed under circumstances where it would be impossible to use a steam-engine. Either of these engines will be found invaluable in the pharmaceutical laboratory or physical workshop. Each possesses advantages peculiar to itself, but both are free from the drawbacks attending the use of steam-engines, as they require no skilled labour, no water, do not increase insurance, make no dirt, and are entirely free from danger.

Meetings for the Week.

Tuesday, May 21.

Royal Institution, 3 p.m. Professor Miller "*On Spectrum Analysis.*"

Pathological Society, 8 p.m.

Wednesday, May 22.

Society of Arts, 8 p.m.

Geological Society, 8 p.m.

Thursday, May 23.

Royal Institution, 3 p.m. Professor Huxley "*On Ethnology.*"

Royal Society, 8½ p.m.

Friday, May 24.

Royal Institution, 8 p.m. Professor Herschel "*On the Falling Stars of 1866-67.*"

Quekett Microscopical Club, University College, 8 p.m. Mr. Ernest Hart "*On the Minute Structure of the Iris.*"

Saturday, May 25.

Royal Institution, 3 p.m. Professor Huxley "*On Ethnology.*"

NOTES AND QUERIES.

Calico Printing.—Sir,—Referring to your note upon calico printing in last week's publication, I shall have pleasure in arranging with "J. K. M" a permanent system of remuneration for the advantages he names, which, if reliable, will stimulate the aniline colour trade. If you will let me have the address of "J. K. M.," I will at once communicate with him.—R. E. B, Manchester.

Caramel Colours.—Sir,—I have noted the correspondence respecting caramel colours in the CHEMICAL NEWS, and I should be glad to learn where glucose can be obtained in manufacturing quantities. There was a "Glucose and Caramel Company" in existence some time since, but it is now defunct; and I am therefore at a loss where to obtain it, and cannot spare the time for making it.—J. W.

Map Varnish.—Sir,—I want to prepare a good map varnish which will dry rapidly If any of your correspondents will kindly instruct me in its preparation through the medium of your valuable section "Notes and Queries," they will confer a favour upon me.—J. S.

Artificial Teeth.—Sir,—Within the last few years some improvements have been made in the manufacture of artificial teeth, by which they are rendered less brittle. I am anxious to find directions for their preparation, and shall be happy to pay any person who will assist me in this matter.—F. T., Leeds.

Crystallisation of Chromates.—Sir,—During the crystallising of bichromate of potash, a coating of light lemon-coloured crystals formed on the front of the bichromate. These crystals did not, however, appear till the crystals of bichromate had almost done forming. The mother liquor at the time was about six or eight degrees warmer than the surrounding atmosphere. If the liquor was allowed to remain in the crystallising pans until perfectly cold, the crystals referred to would increase to four or six inches in thickness. The form of these crystals was an oblique four-sided prism. Now, this did not appear from want of sulphuric acid; if that was the case, the crystals would have been green. The amount of potash required to decompose the oxide of chromium was calculated correctly and added. Has any of your readers who may be acquainted with the manufacture of bichromate of potash ever noticed the formation of the crystals named, and to what cause can their appearance be traced? —H.

ANSWERS TO CORRESPONDENTS.

F. L. and M. P. S.—Your communications are declined, with thanks.

J. W. T. is informed that a letter from Canada, in reply to an advertisement, has been sent to our office.

M. Jenkins.—What is usually known as queen's metal is an alloy formed of two parts of tin and one part each of lead, antimony, and bismuth.

A Student.—The term "wad" is applied to two distinct minerals. It generally means an ore of manganese mixed with iron; but in Cumberland the term is applied to plumbago.

A. K.—Tetradymite consists of sulphide and tellurido of bismuth with impurities. Its name, however, is not derived from the fact of its being composed of four elements, but from its occurrence in quadruple crystals.

Clericus.—Chloroform is, perhaps, the best substance you can use for removing paint stains from oak. You must remember that it will likewise attack the varnish.

Communications have been received from S. Mellor; Dr. Adriani; F. Field; T. Sherlock; G. F. Rodwell; W. Webb; Price's Patent Candle Company; J. Sullivan; Lloyd Smith; the Walker Alkali Company; T. Parkins; C. Ogleby and Co.; J. Muspratt and Sons; J. F. MacFarlan and Co.; Davey, Yates, and Routledge; Allen and Hanbury; J. J. Vaughan; Professor B. Silliman (with enclosure); F. C. Calvert; Geological Society (with enclosure); Clericus; Henry Charlton; R. E. B.; J. V.; W. Gossage; Editors of Journal of Mining; William Schofield; E. Frankland (with enclosure); Runcorn Soap and Alkali Company (with enclosure); S. Muspratt, M.D., &c.; W. B.; A. C. Hadland and Co.; R. Wilkinson; Messrs. Denton and Co.; W. Bush; Pullar and Son.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Direct Estimation of Boracic Acid, by Professor F. Wöhler.

In order to estimate directly the boracic acid contained in datolite, $3(CaO,BO_3)+3CaO,3HO,4SiO_3$, place the mineral in a small tubulated retort, decompose it with hydrochloric acid, and distil the mixture to dryness; pour on to the residue the distillate (which contains boracic acid), and allow it to digest to separate the silica. In the liquid precipitate the lime by means of oxalate of potash, taking care not to add it in too great excess. Then, after filtration and concentration, precipitate the boracic acid in the form of double fluoride of boron and potassium. For this purpose, add a little potash to the material in a platinum capsule, then pour over the mixture a slight excess of hydrofluoric acid, and evaporate the solution to dryness. To remove the other salts it suffices to treat the mass with a moderately concentrated solution of acetate of potash; then allow it to digest and throw on to a filter the double fluoride of boron and potassium, and wash it with the same solution of acetate. Then wash with dilute alcohol to remove the acetate of potash; the double fluoride is then dried at 100° C. and weighed.

On Determining the Proportional Relation between Silver and Chloride of Ammonium, by Professor J. S. Stas.

The method of determination I used is that described in my former article. To prevent the loss of hydrochloric acid, which would have been set free by introducing chloride of ammonium into a hot acid solution of nitrate of silver, I neutralised with pure ammonia the excess of nitric acid used for dissolving the silver. The following is the manner in which I proceeded:—

After having added to the solution of silver in nitric acid 100 *cubic centimetres of water for each grain of metal* dissolved, I poured in, drop by drop, a solution of pure ammonia. When the liquid was alkaline, I neutralised it by a suitable addition of *pure acetic acid*.

In order that the double decomposition might take place under absolutely identical conditions, I neutralised with ammonia both the silver solution to be precipitated while cold, and that at 100°. In order that the solution should be about 100° at the moment of the double decomposition, I kept the flask or globe in which the assay was made in boiling water *for two hours*, and without removing it from the bath I introduced the chloride of ammonium. As the precipitation took place at a high temperature, the liquid cleared itself the moment a complete mixture of the reagents had taken place.

I weighed in air* the chloride of ammonium and the silver employed, assuming, according to Prout's hypothesis, the weight of the molecule of chloride of ammonium to be 53·50, and that of silver 108·00. The excess of the metal remaining in the liquid after the double decomposition was determined without removing the flask or globe from the bath. For this purpose I directed a pencil of yellow light to the surface of the liquid in which I wished to measure the silver. The comparative assay, made at the ordinary temperature, was performed by means of the apparatus for *titration*, described on page 137.

The following table contains the results of these three sets of experiments. I have added three determinations taken from my former work; they were made with chloride of ammonium produced at the ordinary temperature by combining directly solutions of ammonia and hydrochloric acid:—

Proportional Relation between Silver and Chloride of Ammonium.

Number of the experiment.	Weight of the sal ammoniac reduced for a vacuum.	Weight of the silver reduced for a vacuum.	Weight of the excess of silver after the double decomposition.	Chloride of ammonium which is equivalent to 100,000 parts of silver.
First Series.—Chloride produced at the Ordinary Temperature by combining Hydrochloric Acid with Solution of Ammonia, determined at the Ordinary Temperature.				
	gr.	gr.	gr.	
IX.†	11·0088	22·2236	0·0300	49·600
X.†	10·92896	22·06734	0·0280	49·599
XI.†	12·26038	24·74991	0·0305	49·598
Second Series.—Chloride sublimed at the Ordinary Pressure, Determination made at the Ordinary Temperature.				
	gr.	gr.	gr.	
I.	11·79643	23·8133	0·0290	49·598
III.	11·80844	23·8376	0·0290	49·597
V.	6·25216	12·62116	0·0140	49·593
VI.	10·71756	21·6355	0·0262	49·597
Third Series.—Chloride sublimed at the Ordinary Pressure, Determination made at 100° Centigrade.				
	gr.	gr.	gr.	
II.	39·62130	79·98313	0·0970	49·5974
IV.	13·40631	27·06320	0·0355	49·602
VII.	7·60107	15·3442	0·0187	49·597
Fourth Series.—Chloride Sublimed in a Vacuum, Determination made at the Ordinary Temperature.				
	gr.	gr.	gr.	
VIII.	13·5129	27·2784	0·0355	49·598
IX.	6·2250	12·5663	0·0140	49·592

The results given in the preceding table prove that, within the limit that must be allowed in making the experiments, *temperature exercises no influence upon the composition of chloride of ammonium or of chloride of silver; they prove further that pressure is without any influence upon the composition of chloride of ammonium.* In fact, whatever may be the mode of preparation of the compound of ammonium, and the temperature at which the double decomposition takes place, *its proportional relation to silver is constant.*

If the admitted constancy of the stable chemical combinations required to be demonstrated, it seems to me that the almost absolute identity of the results of the four series of determinations is sufficient to prove it. This constancy is the more remarkable, since sal ammoniac can, as I have observed, condense ammoniacal gas or hydrochloric acid, *in the same way that a number of bodies condense gases and vapours completely foreign to them in their constituent elements.*

Among the twelve determinations given in the table

* To reduce to a vacuum the chloride of ammonium weighed in air I weighed in the air and *in vacuo* a portion of the sal ammoniac that I intended to use. These assays convinced me of a fact that had already been stated by M. Marignac—viz., that the augmentation of weight obtained by weighing the pulverulent chloride directly *in vacuo* was always less than would have been calculated from the density. I found that 100,000 parts of pulverulent chloride weighed in air represented from 100,077 to 100,084 parts of the same compound weighed *in vacuo*. M. Marignac gives the figure 100,080 as the mean of the extremes. These weighings also showed me that the density of compact sal ammoniac differs appreciably, according as it is transparent and vitreous, or opaque and amorphous.

† These experiments are taken from my former work; the numbers of the experiments have been retained in the table.

there is one, No. II., which was made upon a quantity of material such as was never before employed in an experiment of this kind. I had a double object in using such large proportions. I wished to render sensible the influence of temperature upon the composition of chloride of silver, if there were any such influence; and then, as I was working with chloride of ammonium that had been sublimed three separate times, twice in vessels of *hard glass*, not attacked by the vapour of chlorine, it should be of an extraordinary purity, and I ought to be able to deduce an important consequence with reference to the hypothesis of Prout. Now, after the double decomposition had taken place upon the weights calculated according to Prout's hypothesis, there remained dissolved in the liquid 0·097 gr. of silver, being a quantity *one hundred times* greater than that which I could have appreciated in the mass of liquid, and certainly *fifty times* greater than that it is possible to measure by taking the trouble.

I invite those who think they can attribute "to errors of observation" or "to the impurity of the materials"‡ the differences observed between the experiment and Prout's hypothesis, to take the trouble of repeating, under the conditions necessary for exactitude, the determination of the proportional relation between chloride of ammonium and silver, and I shall wait with entire confidence the result of their investigation.

In speaking thus I do not pretend that the figures I have given are absolutely exact—that is to say, that they may not be affected by a constant error. I am even sure of the contrary, and in the conditions in which I was placed the constant error must have attained its maximum. In fact, the operation for deducing the proportional relation between the chloride and the silver involves an uncertainty to which I have already drawn the attention of chemists in my "*Recherches sur les Rapports Réciproques des Poids Atomiques.*" This uncertainty consists in the fact that an argentiferous liquid, from which nearly all the metal has been precipitated by a solution of chloride of potassium, sodium, or ammonium, but which still contains one or two milligrammes of silver per litre, precipitates both on the addition of a normal solution of silver and of an alkaline chloride. I find this phenomenon is the more pronounced the less acid the liquid is, and the more alkaline nitrate it contains. Now, in the double decompositions between nitrate of silver and chloride of ammonium, I was obliged, for the reason given above, to neutralise the excess of nitric acid by ammonia, and, for the same reason, I only added a slight excess of acetic acid. The conditions then, which are the primary cause of the uncertainty, are both present, and they must, as I have said before, bring the constant error to a maximum. But after allowing very largely for this constant error, there remains such a considerable difference between the calculated and observed results, that it is quite impossible to attribute it to any other cause than to the inexactitude of Prout's hypothesis.

Civil List Pensions.—The following pensions on the Civil List have been recently granted:—100*l.* a year to Lady Harris, widow of Sir William Snow Harris, in consideration of her husband's valuable invention of the system of lightning conductors. 100*l.* a year to the Rev. Miles Joseph Berkeley, on account of his eminent services, as a botanist, to practical horticulture and agriculture. 95*l.* a year to George Cruikshank, Esq., on account of his great merit as an artist.

‡ *Cosmos*, vol. xvii. p. 653.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Gallery V.—Class 44: Chemical and Pharmaceutical Products.

We must not forget to mention, in a few words, the celebrated proprietor and director of the Pont-Labbé works, a real model establishment, M. L. Paisant. Founded in 1840 for the manufacture of starches and their conversion into alcohol, syrup, and dextrine, it was very soon affected by the potato disease. The establishment is not now confined to its original manufactures; it produces all sorts of chemical substances from the seaweed so abounding on the Brittany coast. It consumes at present 1800 tons of raw material, and delivers to commerce in places far inland 160,000 litres of kelp or lixiviating ash produced from seaweed. It is extensively used as an excellent manure over a great portion of Finisterre.

M. Paisant is a great manufacturer, much esteemed by all the inhabitants, and the jury should take him into consideration. He has developed his establishment on a large scale; he has paid great attention to the welfare of the population among which he dwells, and has ameliorated the condition of the working classes physically and morally, increasing their wages, constructing their dwellings, which leave nothing to be desired as to salubrity, and has founded a mutual helping savings bank, in case of the stopping of work or sickness, and for the relief of women and children.

In the first rank of the manufacturers of chemical products we must place M. Deiss, of Paris, Marseilles, and Lyons, the originator of the fabrication of sulphuret of carbon, and its use in the extraction of all fatty matters. In 1847, sulphuret of carbon, produced in a laboratory, cost 60 francs the kilogramme. In 1867, M. Deiss sells it at the rate of 35 centimes (3½d.) a kilogramme. In 1848 the treatment of caoutchouc by sulphuret of carbon was hardly known. Sulphuret of carbon now takes up, from the residues of many industries, several millions of kilogrammes of fatty matters hitherto thrown away; and this application is one of the most brilliant discoveries of modern times. No matter how powerful the presses, a considerable quantity of oil is left in the cakes of oleaginous seeds. The sulphuret of carbon supplies, wonderfully, a remedy for this imperfection, by taking out all the remaining oil. Paris, Brussels, Lyons, and Marseilles possess large establishments for the extraction of the hitherto lost fatty matters. Since 1862, these industrial works have been well appreciated by the juries. Dr. Hofmann placed them in the first rank. Since a few years back, they have attained an enormous size. At the Carthusian Friary of Marseilles, Boulevard Achard, a gigantic extractor treats, in 36 hours, 43 cubic metres of pulp or lees of olive, using 45 tons of sulphuret of carbon, which penetrates into the whole mass, takes up the oil, and deposits it in the distilling apparatus. The sulphuret of carbon is then passed through a worm, regenerated, and condensed, without any sensible loss, ready to take up another quantity of oil. Thirty to thirty-five tons of oily substances are thus extracted at each operation.

At Lyons they used to throw into the Rhone, annually, the oil that might have been used for making 5000 tons of soap. Now, on the contrary, the application is complete: oil in its neutral state is entirely utilised, and the process of M. Deiss is welcomed in the industrial arts.

M. Collas, our esteemed friend and neighbour, No. 8, Rue Dauphine, was the first to introduce in France, about 1840, the manufacture, mechanically, of medical lozenges. They are stamped out as in the Mint, like coins of different shapes, and bear inscriptions indicative of quality and the method of using them. He discovered, in 1848, benzine in coal oil, and at once introduced it into

commerce for cleansing stuffs; also nitro-benzine, which is a cheap substitute for the essence of bitter almonds. The creation of this substance really led to the beautiful aniline colours. The Society of Mulhouse said of him, in their meeting of March 22—"M. Collas has introduced into commerce benzine and nitro-benzine; the first seems for taking out stains from stuffs, the second is used in perfumery; . . . . . he has not found out any colouring matter, but we are now in possession of a product hitherto impossible to be procured. Dr. Hofmann repeated the experiments of M. Runge on kyanol (aniline). . . . . Perkin reproduced a reaction first indicated by Berzelius, and a great industry has been created. . . . . ." Thus the Mulhouse Society give all the credit to M. Collas for the means of making aniline colours.

Phosphates of lime, considered in the light of physiology and pharmacy, have been one of the favourite studies of M. Collas. He discovered and demonstrated by experiment that gelatinous phosphate of lime possessed the singular property of facilitating the putrefaction of animal matters. It acts under these circumstances not as forming, but as aiding powerfully, the development of those infusoria which determine the decomposition of animal matters. Thus it is a powerful digestive agent, and as experiments prove that diabetes and glucolucie depend upon the nature of the blood, and that the excellent preparations of phosphate of soda of M. Collas, his phosphoric lemonade, and milk of hydrated phosphate of lime are most successful.

During these last years, stimulated by the experiments of M. Lucie, M. Collas prepares iron reduced by electricity, quite pure, by aid of one Bunsen pile acting on chloride of iron in solution. The iron is deposited as a coating, while the several impurities fall to the bottom, leaving the iron quite pure. Obtained thus in grains or in very friable plates, it is easily reduced to an impalpable powder, like the copper of M. Oudry. It is, however, very oxidisable, and is obliged to be enclosed, for medical use, in gelatine capsules. Each capsule full of iron weighs 10 grammes and 50 centigrammes (or about 162 grains); the maximum dose per diem is five capsules, and observations continually prove the striking efficacy of the administration of metallic iron.

We recollect having seen in the glass case of M. Rousseau, another first-class maker of chemical products, a great phial of iron reduced by electricity, which was very astonishing to behold. It was not black like that of M. Collas, but it had the grey metallic colour of iron. He founded in 1843 an establishment for the fabrication and sale of chemical products and apparatus necessary for physical manipulation and the instruction of students. For twenty years he resided in the Rue de l'Ecole de Médecine, and three years ago he removed to the Rue des Ecoles. His customers have increased daily under our very eyes, and this augmentation proves that he has well fulfilled his engagements towards the public. In Class 44, M. Rousseau shows what he ordinarily manufactures and delivers for sale:—1. Specimens or samples of products and reagents. 2. A series of oxides and salts for colouring silicates, the cost of which he has lowered without diminishing the quality, so as to compete favourably with foreign markets. 3. Masses of sodium that he was the first to manufacture commercially and cheaply, so as to render aluminium available at a moderate cost, and on which account M. Sainte-Claire Deville made him one of his partners. 4. Magnesium also prepared for sale commercially, along with other metals recently discovered—such as cæsium, rubidium, thallium, &c. 5. Pyrogallic acid for photographic purposes, of which he sells 1500 to 1800 kilos. per annum. 6. Benzoic acid employed in the preparation of aniline colours; of this he undoubtedly extracts several thousands of tons every year from the urine of cows, carefully collected from the numerous dairies about Paris. Before he began his work all the benzoic acid consumed in France came from Germany. The great aim of M. Rousseau is to give to the commercial world, at a reasonable price, materials which were unattainable with profit by the manufacturing world. He exhibits in Class 51 a stove, which advantageously replaces that of Gay-Lussac, and which only costs 25 fr. instead of 45 fr.; a new densimeter easily employed; plates and cylinders of artificial carbon for the cheap use of Bunsen's batteries. He also shows in Class 90, marked at the price of 200 fr. (8l.), a collection of products for the elementary instruction of chemical students, with an explanatory volume. We mention other innovations made in France by the same distinguished hand. In 1839 he patented the first process for obtaining sulphuric acid from pyrites; there was at that time a great establishment at Javel, but sulphur, then at a high price, suddenly fell in the market, and pyrites could no longer compete with it. To M. Rousseau is due, also, the first idea of the agglomerated coal, or "Charbons de Paris," extensively used in France for culinary purposes. M. Popelin-du-Cazze, who bought the patent, has been very successful on the large scale. In 1849 he organised the mode of extraction of sugar by the double action of lime and carbonic acid, which has now been followed for the last twenty-four years under the name of Rousseau's process by all Europe. He also discovered a decolorising charcoal black at a cheap price—6 fr. the 100 kilogs. (220·5 lbs.)—for refining, in place of the cumbersome and dirty substances formerly used.

M. Huillard, the elder, of Paris, exhibits as the special objects manufactured by him orseille, orcine, orceine, eriphthine, eryphic acid, &c. The other mineral substances, the protoxide and sesquioxide of cobalt, and five carbonates, the arseniate, phosphate, silicate, borate, sulphate, nitrate, and chloride of cobalt; and the carbonate, nitrate, and chloride of cadmium are admirably crystallised. These are very creditable, and reflect much honour upon M. Jourdin, the young and energetic superintendent of the works, who is actively engaged in solving the following problems:—1. The delivery to commerce of orseille, liquid orseille, orcelline, extract of orseille, or imperial red. 2. The production on a large scale of cobalt blues to rival those of Germany. M. Huillard has succeeded in rendering lower the price of cobalt blues for stuffs and wall-paper, while at the same time they are more durably fixed. The Bank of France has adopted them for the 100 fr. bank-notes, inimitable by any photographic process; also for the 20 centimes (blue twopenny) postage stamps, though they are of a greenish hue by candle-light, but readily distinguishable from the others.

M. Eusèbe, of Paris, exhibits some very fine aniline greens and reds obtained by carbo-humic acid. He has yielded the full right of manufacture to M. J. J. Müller, of Basle. He has two magnificent collections of samples which can rival with any of the other manufacturers in the Palace.

M. Jean Rod has already received our compliments for the splendid specimen of crystallised and almost white rosaniline. He challenges the first markets of Paris or London and the greatest houses to produce better. He produces daily 175 kilos. of muriate of rosaniline, aniline blues, violet, and greens. He also produces, with the same substances, and delivers to the commercial world—hydrochlorate of aniline, a red dye; hydrate of monophenylic rosaniline, giving a reddish-violet tint; hydrochlorate of diphenylic rosaniline, giving a blue violet; hydrochlorate of triphenylic rosaniline, giving a blue dye.

In another collection of violets exhibited by him under the name of Parma or Alexandria violet, in the preparation of which ethyl replaces phenyl—Hofmann's process—exhibited also by M. Menier, M. Rod exhibits a cup of 500 grammes (1⅛ lb. avoirdupois) of cyanide or quinoline blue. To enumerate the splendid display of M. Rod would be too much for our space; suffice it to say that we warmly recommend him to the attention of the jury.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, May 16.

F. A. Abel, Esq., F.R.S., *Vice-President, in the Chair.*

The minutes of the previous meeting were read and confirmed; Mr. F. W. Peterson was formally admitted a Fellow of the Society; and the names of William Phipson Beale, barrister-at-law, Stone Buildings; Alfred Coleman, Plough Court, Lombard Street; and Augustus Alfred Wood, 74, Cheapside, were read for the second time.

Mr. Perkin, F.R.S., said he had a few observations to make upon some experiments with which he had been lately engaged. Coumarine, it is well known, is the crystalline principle of the Tonka bean, and was first analysed by Delalande and afterwards by Bleibtren. The formula of this substance is $C_9H_6O_2$. When heated with potash, it assimilates an equivalent of water, and becomes converted into coumaric acid $C_9H_8O_3$. This, again, if fused with potash, yields salicylic and acetic acids, with evolution of hydrogen. On account of this latter transformation, coumarine is viewed as a derivative of salicyle. Having been lately a good deal engaged with the study of salicyle derivatives, he had often endeavoured to obtain some clue to the constitution of coumarine, hoping that he might eventually be able to build it up from some salicyle compound. About ten days or a fortnight ago he obtained a beautiful crystalline product, possessing both the odour and composition of coumarine. When heated with potash, it yielded an acid, apparently identical with coumaric acid, and on fusing it with potash it was converted into salicylic acid—it was, in fact, artificial coumarine. He had not compared it side by side with the natural product, but expected to do so in the course of a few days. As he hoped shortly to bring an account of his results before the Society, he would refrain from entering into further details, except to state that he obtained his product from the sodium derivative of salicyle by means of acetic anhydride. Knowing the interest that chemists generally take in the artificial formation of natural products, he thought these remarks would not be unacceptable.

An elaborate paper "*On the Constitution of the Phosphites*," by Professor C. Rammelsberg, was read by the Secretary. The author commences with an historical notice of previous researches, which appear to have left unsolved the amount of water, or rather the condition of the hydrogen, contained in the salts of phosphorous acid, so that the constitution of these bodies might be represented by one or other of the following formulæ:—

$$H_2R''_2P_2O_6 \text{ and } H_4R''_2P_2O_7.$$

To elucidate this question, the author prepared and analysed a great many different phosphites, and the results in the case of the dyadic metals warrant the adoption of the second formula. Thus the barium and nickel salts have precisely the above composition, the strontium and calcium salts containing extra two atoms of water, and magnesium salts were prepared containing respectively five and twelve atoms of water of crystallisation. Zinc and magnesium appear, however, to give rise to the production of salts of two classes, whilst lead, copper, manganese, &c., always form compounds containing one atom of hydrogen which cannot be replaced by a metal.

Class A.	Class B.
HK_2PO_3	$H_4Ba_2P_2O_7$
$HMnPO_3$	$H_4Ca_2P_2O_7$
$HZnPO_3$	$H_4Mg_2P_2O_7$
$HPbPO_3$	$[H_4Zn_2P_2O_7]$
$[HMgPO_3]$	

Phosphorous acid seems to be incapable of forming acid salts. The crystallised acid itself contains one atom of water, and any attempt to expel the latter by the application of heat destroys the substance, with evolution of gaseous phosphide of hydrogen.*

After the Chairman had moved a vote of thanks to the author, and invited discussion upon the subject of the communication,

Dr. J. H. Gladstone said it was sometimes easy to build up a compound and speculate upon its constitution, if we knew already the nature of the body from which it was prepared. The starting-point in this case was the terchloride of phosphorus, which, undergoing decomposition by water, furnished the acid in question:—

$$PCl_3 + 3H_2O = 3HCl + H_3PO_3.$$

The acid itself was stated, by Prof. Rammelsberg, to have the following composition:—$H_4P_2O_5 + H_2O$. To obtain this result, there were two stages, the first or intermediate product being the oxychloride of phosphorus—

$$\text{I. } 2(PCl_3) + \left.\begin{matrix}H\\H\end{matrix}\right\}O = \left.\begin{matrix}PCl_2\\PCl_2\end{matrix}\right\}O + 2HCl.$$

$$\text{II. } \left.\begin{matrix}PCl_2\\PCl_2\end{matrix}\right\}O + 4H_2O = \left.\begin{matrix}P(HO)_2\\P(HO)_2\end{matrix}\right\}O + 4HCl.$$

The Secretary then read a paper by Dr. A. Dupré "*On the Changes in the Proportion of Acid and Sugar present in Grapes during the Progress of Ripening.*" It has frequently been inferred that the tartaric and malic acids in grape-juice become transformed into sugar during the process of ripening; but the author's experiments tend to disprove this assertion. Dr. Dupré collected and experimented upon a hundred berries of Riesling grapes gathered at intervals of a month, commencing with September last, and the amounts of tartaric acid, free and combined, and also of sugar, were determined in the separated juices. The proportion of sugar increased in order of time from 2·98 to 12·10, and even to 16·20 per cent. in the juice of the perfectly ripe fruit; whilst the entire berries showed but a slight diminution or no appreciable change in the total amount of acid present. The saccharine matter could not, therefore, have been directly derived from the organic acid or its salts contained in the grape; but the author thinks it possible that the presence of such acid effects a change resulting in the production of sugar similar to that known to occur in the conversion of starch into sugar by the action of sulphuric and other acids. Further experiments, even more decisive in their character, were made upon Gutedel and Muscatel grapes, gathered at the same time and from the same vine, but in various stages of ripeness. In some of the unripe berries there was absolutely no sugar, whilst in others nearly ripe 8·87 per cent. of sugar was found; but the amount of free acid estimated in a hundred grapes was almost the same in three samples of Gutedel, and actually increased with the ripening of the Muscatel.

Another paper, by the same author, was then read. It is entitled, "*On some of the Effects produced by the Addition of Plaster of Paris to Must.*" It seems to be a common practice in the wine-growing countries to add the substance named in the heading to grape-juice either before or during the process of fermentation, the alleged object being to increase the richness of the must by the absorption of water. Although this action doubtless occurs, the author points out that the loss of material in the course of such treatment (by mechanical retention in the gypsum) never compensates for the augmentation of sugar in the remaining juice, and suggests that a partial evaporation should be resorted to, or some sugar added instead of the earthy sulphate. Numerical results are quoted in support of this assertion, and the chemical changes induced by the employment of the plaster are fully stated. Consisting, as it does, of sulphate with a little carbonate of lime, it not only decomposes the tartrates in the grape, with liberation of the purgative sulphate of potash, but also neutralises and removes some

* An earlier statement respecting the phosphites, by the same author, appeared at page 241 of the present volume.—Ed. *C. N.*

of the free tartaric acid—an essential constituent of wine—leaving the malic acid still soluble, thus deteriorating, says the author, the condition of the juice, and assimilating it to the quality of that obtained from unripe fruit. Wine made according to the above system will be characterised—1st, by a more or less complete absence of tartaric acid; 2nd, by containing sulphates in solution; and 3rd, by giving, on incineration of the residue, a larger proportion of ash and diminished amounts both of phosphate and carbonate.

Dr. Odling, in answer to Colonel Yorke, said that chloride of barium always indicated the presence of dissolved sulphates in sherry, but gave no precipitate in a true claret.

The Secretary then proceeded to describe "*An Adapter to be used in connexion with Sulphuretted Hydrogen Apparatus*," by the Rev. B. W. Gibsone, M.A., B.Sc. This arrangement consists of an ordinary glass funnel, the limb of which fits into a conical bung of vulcanised india-rubber, whilst the top is covered with a flat plate of the same material, perforated with three holes, through one of which a current of sulphuretted hydrogen is made to enter, another aperture serving as the exit pipe for the excess of gas, which it is proposed to absorb by passing through a succession of Woulff's bottles charged with ammonia. The third is a spare hole usually closed with a stopper. Within the funnel itself is a long glass tube, with a thistle-shaped expansion at top, into which is fitted a cork and short piece of tube for connexion with the central aperture above it, and this funnel tube has also within it a cane of glass rod of greater length than itself, with a bead placed inside the thistle as a means of lifting it from close contact with the apex of the larger funnel, which is kept moistened with water. When thus lifted a current of the gas makes its escape from the lower orifice of the funnel, and is made available by passing through any solution contained in the bottle to which the bung and adapter are fitted. When the action is completed the flow of gas is stopped simply by removing the vessel, when the weight of the glass rod causes the funnel tube to descend, and no more gas can pass. For a description of his sulphuretted hydrogen generator the author referred to a sketch of the apparatus which had already appeared in the Chemical News (*vide* p. 240 of present volume).

An elaborate paper "*On the Practical Loss of Soda in the Alkali Manufacture*," was then read by Mr. C. R. Wright, B.Sc. The author has had an opportunity of studying the minute details of Le Blanc's process as carried out in a large factory making upwards of 150 tons of alkali weekly, and the products were examined at every stage for the purpose of ascertaining the loss of soda during the process of conversion. A capital series of analyses are given, which show the average composition of salt cake, black ash, soda ash, refined ash, and the dried vat waste, which last seems to contain a notable quantity of alkali, both in the soluble and insoluble states. The total loss of sodium in the process of converting salt into refined soda ash is set down at 20·24 per cent., and consists of the following items:—

	Per cent.
Previous to Lixiviation.	
Sulphate of sodium left undecomposed	3·49
Insoluble sodic compounds formed	5·44
Volatilisation of sodic compounds	1·14
During and after Lixiviation.	
Soluble alkali left in vat waste	3·61
Oxidation of sulphide of sodium	—
Leakage and losses in white ash process	6·56
Total loss	20·24

The speaker made reference to the previous researches of Mr. Kynaston,† and also to those of Mr. James Hargreaves lately published in the Chemical News. The last-named gentleman affirms that one-seventh part of the chloride of sodium escapes conversion into sodic carbonate, or is lost in the process of manufacture.

The Chairman moved a vote of thanks to the authors of the respective communications, and, at a late hour, adjourned the meeting until June 6, when Sir Benjamin Brodie will deliver a lecture "*On Ideal Chemistry*."

† *Journ. Chem. Soc.* xi. 135.

ROYAL INSTITUTION.

Tuesday, May 14, 1867.

A Course of Four Lectures on Spectrum Analysis with its Applications to Astronomy, by* William Allen Miller, *M.D., LL.D., Treasurer and V.P.R.S., Professor of Chemistry, King's College, London.*

Lecture I.

Nature of the Prismatic Spectrum.—Spectra of Solids.—Spectra of Gases and Vapours.—Spectra produced by Absorption.—Spectra of Rays of Heat, of Light, and of Chemical Action.

My object in the course of lectures upon which we enter to-day will be to endeavour to place before you distinctly the mode in which, by the optical analysis of light from various sources, we have learned not only to distinguish the physical condition of the body which emits that light, but also, in many cases, to ascertain its composition.

A new method of investigation is thus placed in our hands. The mode of analysis, it is true, has been practised before to a certain extent, but it involves the application of principles which, until quite recently, had been overlooked. It enables us to deal with matter at infinite distances, for, provided we can see it, we are able to examine it by this optical method. It also enables us to examine matter in quantities so minute that no balance can estimate its amount. We are therefore brought face to face, by its means, with infinitude of space and distance, and infinitude of minuteness.

I know that those who have been in the habit of attending lectures at this Institution have from time to time watched with interest the progress of this new branch of investigation. They have had opportunities from time to time of seeing the steps, by which it has been raised to its present position, illustrated and experimented on; but although many who may be honouring me with their attendance on this occasion may not for the first time be considering these wonderful phenomena, the intrinsic interest which they possess—the variety and beauty of experimental illustration of which they admit—induce me to hope that even those who are in some measure familiar with the facts will yet be able to follow me with interest through the theoretical considerations which I may have to bring before them, and through the somewhat minute detail upon which, from time to time, I shall have to enter.

Without further preface, then, let me proceed to the examination of the method of inquiry—the method of optical analysis.

No doubt every one present knows what is meant by the prismatic spectrum. If we take a beam of white light, and transmit it through a triangular mass of glass properly cut and polished, we divert it from its original direction—we refract it from its course. Now, light may be artificially produced in various ways, and one of the most general of these modes of obtaining light consists in raising the temperature of the body which is to be experimented upon. Every opaque solid object gives out light in large quantity when its temperature is sufficiently raised. At a temperature of about a thousand degrees of Fahrenheit every substance becomes what is called red-hot—that is to say, begins to emit red light. As we raise the temperature, the colour of the light

* Reported specially for this paper, and revised by the author.

becomes more brilliant, and it passes at length into a dazzling white. That is a general effect whenever any solid opaque substance is sufficiently heated. I shall take advantage of this fact in order to be able to produce the beam of light upon which we shall have to experiment in a part of this investigation, and for this purpose it will be my desire to show you, first of all, the solid body itself which is producing the light, because, hereafter, I shall have to show you other sources of light which are not solid, and which are giving out light of a different kind.

In the first place, then, I shall, by the powerful heat produced by the current of electricity of the voltaic battery, cause intense ignition of two points of charcoal. You will excuse me if from time to time in these lectures I bring before you what appear to be very simple experiments. Philosophically, nothing is trifling if it proves a principle. In this case I shall throw upon the screen the image of the two charcoal points. My object here is simply that you may see that although we get an intense light and a white light, it is produced by a body in the solid state. The charcoal points do not melt, and there is no visible vapour given off. I do not say there is no vapour given off, but there is none visible. On throwing this image upon the screen, we shall see, first of all, the incandescent points themselves, separated from each other to a considerable distance. Having shown you the points, we will then examine optically the nature of the light which those points are emitting.

You will observe that the image of the line of light is produced by allowing simply a thin slice of light to pass through a very narrow slit. It is now falling upon the surface of a mirror, and from that mirror it is reflected upon the screen. We will now withdraw the mirror altogether, and allow the light to pass through the prisms which have been arranged for its dispersion. So long as these points of ignited matter are in the solid condition, we have that beautiful elongated image which now appears upon the screen, and which is, in fact, composed of a series of slices of light, each of which is of a particular and definite colour. You will notice that the extremity which is nearest to me—the red—is that which is least refracted from the original direction, and the extremity which is farthest from me—the violet—is that which is most refracted from the original direction. Now, the point I particularly wish to insist upon in this observation is that we are here dealing with a *solid* body, which is not capable of being converted into vapour so as to produce flame. If time allowed, I should like to show that this, which is observed in the case of charcoal, is a general fact with regard to solid bodies. For example, if, instead of heating charcoal points by the voltaic current, I were to take a cylinder of lime and introduce it into the intense heat of the oxy-hydrogen jet, or if I were to take a piece of magnesium, a piece of silica, a mass of iron, or a mass of platinum, and heat it so as to produce incandescence or intense ignition, the spectrum which would be obtained from its light would, in every case, when examined, be seen to be continuous, like that charcoal spectrum. [I dare say you noticed flashes of light which crossed that spectrum from time to time. They were due to slight impurities in the charcoal points, and these impurities become volatilised in the intense heat. With them we shall have presently to deal.] The particular fact upon which I wish now to insist is that, as a general rule, whenever a solid body is heated, it gives out light, which, when examined by the prism, furnishes us with a continuous spectrum. That is to say, this light is made up of an infinite number of slices of light. By means of a rough model, I may make this more clear. Suppose that this white bar represents to us a band of white light—the light, in fact, which we first got before it is dispersed by the prism. If we cause it to pass through the prism, it is spread out in this fan-like manner, every piece of that spectrum being composed of a slice of light of the particular colour which is there represented; and these slices of light, overlapping each other continuously, produce that blending of colour which is inimitable by art, but which is so brilliant and so beautiful in its effect.

These, then, are the results of the examination of bodies in the solid condition, and for the purpose of recalling this to your mind we have here a diagram representing the spectrum of any sufficiently luminous solid body. And, further, if the solid happens to melt, it still gives out a continuous spectrum. A mass of melted cast-iron, for instance, would furnish a continuous spectrum, as in the case of charcoal. Or if we were to take any other metal which can be heated sufficiently to be melted without boiling and volatilising, we should obtain a similar result. I cannot show you this experiment, because I am not able by means of the voltaic battery sufficiently to regulate the heat.

Here let me notice that in spectra of this kind we have no clue to the chemical nature of the body which produces the spectrum. But if we go a step further, and heat the body sufficiently to convert it into vapour, the spectrum which is then obtained is quite of a different nature. Instead of having a continuous spectrum, we shall have an interrupted spectrum; and I am going now to prove to you that the body upon which I am experimenting is converted into vapour before it furnishes a spectrum, and for this purpose shall introduce into the lamp a charcoal cup, upon which we shall place a piece of silver. That silver will immediately melt with the intense heat of the current, and as the current is continued, it will not merely melt, but it will actually boil, and become distilled. In fact, silver has been distilled on a large scale by Stas, for the purpose of its purification. [The image of the charcoal points on which the silver was placed, was thrown on the screen.] That beautiful green arc is the vapour of silver. The silver, you will remember, appears on the upper part of the screen, in consequence of the inversion of the image. What in the lamp is the lower part is here upon the screen the upper part. You will see a number of little glowing points, which are the distilled silver. Well, now, if we could manage to open out these glowing points of melted silver (but which we cannot in the present form of our experiment), we should see that they were giving out light of all colours, but the arc itself is giving out light of a particular colour.

We shall now examine the mode of discriminating between silver and other bodies, by means of this process of optical analysis. In another lamp I have exactly the same arrangement as that which you have here seen thrown upon the screen; but, instead of making the image of the points fall directly upon the screen, I shall let a slice of light only fall upon a lens in front of the slit, and then upon a prism. Now, you will notice that the instant the temperature rises sufficiently we get these two magnificent green bands. These two bands are the characteristic marks of silver in vapour. They constitute the arc of light which we saw just now upon the screen, and which is here, by means of the prism, spread into its component parts. You will notice that there is on the ground of these bands a small amount of light, which is due to the dispersion of the light from the charcoal points. We cannot avoid that. In these cases we do not get the pure light of the substance upon the points, because the heat which is produced is sufficient to give us a tolerably strong spectrum of the charcoal points. But you will observe how very much those green lines predominate over the other light in that spectrum.

The next fact which I have to bring before you is that, though every substance which is capable of being converted into vapour gives a spectrum, it gives a spectrum *of its own*. If you take substances which to the naked eye appear to possess exactly the same colour, the moment you place them in the voltaic arc the vapour given out by each is capable of being distinguished from the others',

and you have a different spectrum for each body. I will illustrate this by means of four different bodies, each giving a green light. I have shown you the spectrum of silver. Now I will take three other bodies, each giving a green light differing a little in its shade from that of the others. The first of these will be metallic copper, which, like other metals, will boil in the intense heat we can here produce. The vapour of copper will give us a spectrum of its own, which, although green, will not be the same as the spectrum of silver. [The spectrum was shown on the screen.] There you see a series of green bands, but in the case of copper there is also a large quantity of red and orange light. You see a series of channeled or grooved spaces through a pale background, due to the light from the charcoal points themselves; but the brilliant portion of the spectrum is produced by the volatilisation of the metal. You will be able readily to contrast this copper spectrum with the spectrum of the silver which we had before. Here, you observe, we have a green, but a green of a different order. Copper is a more fixed metal than silver, but by means of this intense heat it becomes converted into vapour. Solid copper, if heated, would not give us this line, but a continuous spectrum like lime and like charcoal.

I am now going to take another metal, which also gives us a green light, and I have a special reason for selecting this metal—magnesium—because we shall consider it from another point of view hereafter. Magnesium is a metal which, when burned with proper precautions, gives rise to a beautiful green light. I dare say we shall see some blue also, but the principal part of the magnesium spectrum will be a green light, but a green of a different shade from the others. In this case you will not see the fact that the green light of magnesium is concentrated into three bands. These three bands are so exceedingly close together that the apparatus we have at our disposal for throwing them on the screen does not enable us to separate them. In this spectrum of magnesium you will see a certain blue line, and there is also a faint line nearer to the yellow.

The fourth metal which I have selected also gives a green light, and this is likewise an extremely interesting body. It is thallium, a metal which was discovered by the application of the method of spectrum analysis. [The spectrum was produced.] That is the band which is perfectly characteristic of thallium. Whenever we have pure thallium we have that single intense green line.

From these experiments it is obvious at any rate that these four substances have totally distinct spectra, although the light which these metals emit appears similar when viewed without the prism. If we were to throw slices of their light directly upon the screen, we should not be able to distinguish these metals from one another; yet, by spreading them out in this fan-like form by prismatic analysis, it is easy to distinguish one from the other.

We have then here a second set of spectra, and these spectra are such as are represented in the second of our diagrams. They are spectra which are not continuous—interrupted spectra—spectra with bright lines. These occur in the case of flames and ignited vapours and gases. It is true that in one instance a solid body has been known to give out lines like this, but it is a substance which I suppose not a dozen people have ever seen. Still it is an important fact that the metal erbium, in the form of its oxide erbia, even in the solid, has the power of giving out bright lines when its spectrum is viewed. This is an awkward fact for the theory of spectrum analysis, but at the same time it is one which must not be ignored. We are always discovering facts which do not square with our theories; and the more these facts are examined, the more surely are we led on to correct our theories, formed, as they always necessarily are, from partial knowledge only. This exception in the case of erbium does not, however, invalidate the general conclusion that whenever we see a body which emits a spectrum having bright lines, that body is in a gaseous condition. We do not as yet know why erbium makes an exception, though at some future time, probably, we shall be able to account for the apparent anomaly, the discovery of which we owe to the observations of Bunsen, to whom also we are indebted for a great part of our knowledge of spectral phenomena.

We must now turn our attention to the cause of these remarkable phenomena; and here I must ask you to follow me for a few moments through a little speculation—not that it is new, but it is speculation which is necessary to connect our ideas—speculation as to what light is. The notion of the nature of light which is at present adopted by philosophers is of this kind:—Filling all space, and filling the interstices of all kinds of matter, there is a subtle something which, for want of a better name, is called "ether." This ether has no weight. It is not light itself, although it is the means by which light is manifested to us. (Mind, this is all speculation, but still it is necessary.) When this ether is thrown into vibration, the vibrations are transmitted through space in right lines, radiating in all directions from the point at which the vibration is produced. When these vibrations have a certain degree of frequency, they produce the phenomena of radiant heat; when they have a somewhat greater frequency, they produce phenomena which are manifested to us in the shape of light; and when these vibrations are more frequent still, they produce phenomena which are manifested to us in chemical effects, or in those effects which Professor Stokes has taught us to associate with the term "fluorescence." Now, the different degrees of frequency with which the ether can be made to vibrate give rise to certain phenomena in light. Not merely is light a vibration of one particular frequency, but the different kinds of light are produced by vibrations differing in the degree of their frequency. Those portions of light which are least refracted (the red) are produced by vibrations of the ether of the lowest frequency; those portions which are most refracted (the violet) are produced by vibrations which are of the greatest frequency; and intermediate between these we have vibrations which produce all the intermediate colours. Now, although it is true every one here is prepared to hear wonderful statements of this kind, I was going to say I scarcely dare to mention the number of these vibrations which it is calculated must occur. Let me first tell you what the width of a wave of light must be. Every wave of this ether, as I have stated, is liable to vary in width according to the colour of the light. In red light the width of a wave is about the 34,000th part of an inch. A wave of violet light is a little more than the 60,000th of an inch—that is to say, there would be a series of 60,000 of these little waves in the space of an inch. That seems a tolerable number, but when we come to the frequency with which these undulations succeed each other, it is perfectly marvellous. In red light there are 482 millions of millions in a second of time, and there are upwards of 707 millions of millions in the case of violet; and we may fill up the interval of the intermediate colours with every conceivable variety between the two.

Now, it is very difficult, when one is looking at these things for the first time—and, indeed, it is always difficult—really to grasp these things, and therefore it is needful that we should come down to something a little more within our ordinary range of conception. I shall, therefore, take an illustration or two from another set of vibrations which you had most admirably illustrated not long since by Professor Tyndall. I cannot help reminding you of one or two beautiful experiments which he brought before you, and which show the beautiful analogy between colour and sound, for, in point of fact, red is the bass of light and violet the treble. You all know that musical notes are produced by a certain series

of vibrations which occur in definite number and at perfectly regular intervals, each note having its own specific number of vibrations—the middle C, for instance, in a pianoforte having 256 vibrations in a second. C in the octave above has double that number, or 512. Here is a tuning-fork which will give us a note which will cause the air in this box to vibrate. [The fork was struck, and held over the mouth of the box, whereon a musical note was obtained.] This fork is producing a certain number of vibrations, which vibrations correspond to a column of air of a particular length contained in the box. Now, if I take another of these forks and hold it over the next box, we get a note which is the octave above. [Experiment performed.] There are twice the number of vibrations in that sound as there were in the sound which I produced first. In the case of musical notes we have a series of these sounds succeeding each other in order. Now we take another fork, and hold it over the next box; then again, the next; and then the last, this being the highest of all. [A musical sound was evoked in each case, each successive note being higher than the preceding.] Now, these are, in point of fact, to sound, what colours are to light. In the case of light, we cannot get through the octave. If we assume that the proportion of vibrations in red light be 100, those for the violet light will not exceed 175; so that the number of vibrations, immense as it is in the case of light, does not embrace so wide a range as in the case of sound, for we may have musical vibrations ranging from 16 in a second to upwards of 2000 in a second.

I have no doubt that many of you know the beautiful experiment which I first saw performed by Dr. Tyndall here, and it is so beautiful that I cannot help desiring to show it to you again, although I may not succeed so well as he does, because it is a matter which he has made his own. The experiment is this:—If we take two tuning-forks, one of them an octave above the other, and each having a thin wire attached to the limb of the fork, and cause them to vibrate, and if we then draw them at the same rate across a piece of smoked glass, we shall have a sinuous line, which will represent the motions of each fork. [A piece of smoked glass was marked as described.] We will put this into the lantern, and you will see on the screen two sinuous lines, one above the other. The lower line is that which is produced by the bass sound; the upper one is that which is produced by the higher sound. The sinuosities in the upper line are double the number of those in the line below. In this we have ocular proof of the difference between the rate of vibration of the two forks. If we were to rule lines across, we should find that the bends in one of these lines were twice as numerous as in the other. This is one of the simplest and, at the same time, the readiest proofs we can have of the difference in the vibrations.

Now I must ask your attention to a third set of spectra. We produced, first of all, a continuous bright spectrum; then an interrupted bright spectrum; but what would happen if we interposed between a continuous spectrum and the light something which would take part of the light away? If we put an opaque body, we should arrest the whole of the light; but if we introduce a transparent coloured substance, we shall intercept portions of the light. Now, by properly choosing our media, we may produce interrupted spectra with black or dark lines upon them; and these are spectra of a high degree of interest. I shall exhibit one or two of the methods by which we may produce these effects. When light is transmitted through a solution of permanganate of potash without using the prism, the liquid has a splendid purple or red colour, according to the degree of dilution. We will first show the spectrum of white light, and then we will interpose the permanganate. You will see, when this solution is placed in a glass cell with flat sides so as to intercept the spectrum from the charcoal points, we obtain a certain number of bands, which occur at intervals upon the screen.

I now proceed to the examination of one of the salts of the rare metal called didymium. Nitrate of didymium and potash furnishes a solution of a very pale red colour. When this is introduced in the course of the ray you see two remarkable bands, one in the orange and the other in the green. Besides this, portions of the blue rays are also cut off. This is a spectrum of absorption produced by a liquid which has so faint a colour that it is scarcely perceptible to the naked eye, yet its spectrum is perfectly characteristic. Dr. Gladstone, who first pointed out this peculiarity of didymium, was enabled by its means to discover didymium as an impurity in other bodies previously supposed to be free from it. These two last spectra, you will observe, are absorption spectra produced by liquids. Such absorbent actions are important, as they enable us in many cases to distinguish the nature of the bodies which are held in solution. Professor Stokes has insisted particularly upon the value of studying this class of actions; and quite recently a valuable paper upon the subject has been communicated to the Royal Society by Mr. Sorby. But, interesting and important as this branch of inquiry is, it would lead us too far astray from our immediate subject, which is specially concerned with the examination of the spectra of bodies at a very high temperature, and the action upon such spectra of gaseous bodies, either at ordinary or at elevated temperatures. The phenomena with which we have at present to deal, enable us to examine the constituents of the gases in furnaces, in active volcanoes, in the fixed stars, in meteors, and in those still more enigmatical bodies, the nebulæ.

For this purpose we will now examine the absorbent action of a brownish-green coloured gas, the peroxide of chlorine. You see there are bands coming out, there being an absorption, particularly of the blue and violet portion of the spectrum, to a very considerable extent. The bands are still more marked in those portions of the spectrum which are not visible until they are received upon a fluorescent screen. The next gas which we will introduce in the same manner, interposing it exactly in the track of the ray, is the peroxide of nitrogen (the red nitrous fumes which are produced whenever a metal, such as copper or mercury, is acted upon by nitric acid). The bands in this gas are in a different portion of the spectrum. The green is almost abolished, and in the green and orange we have a variety of dark bands appearing. These bands are of particular interest because they were the first absorption bands which were observed. Sir David Brewster, who discovered them, thought he saw in them a clue to the explanation of certain bands known as Fraünhofer's lines which are observed in the sun's light. This turned out to be only a partial foreshadowing of the truth, but still the fact is interesting in the history of these discoveries.

I have now shown you absorption by two coloured gases, both of them, however, at the temperature of the air. Suppose we now take a substance which is highly heated, and then examine what will be the effect of transmitting light through a vapour of this description. For this purpose I will now place in the lamp a substance which gives a light of one colour only. Sodium, when converted into vapour, gives out light concentrated into two extremely narrow bands, very close together; these are actual mathematical lines of light which cross the spectrum in the midst of the yellow. I cannot show you these lines on the screen, for the form of the apparatus is not calculated for the production of these extremely sharp lines. As the temperature rises, the sodium becomes converted into vapour, and it will gradually become more and more brilliant until you will see that this bright line is crossed by an intense black line, showing itself upon the screen in the position which was, a few moments ago, occupied by the sodium line itself. It flickers for an instant, and then it gradually fades. Again it appears, and you may now see distinctly the

black line of the sodium thrown upon the screen. That is an experiment which, simple as it looks, is really the foundation of the whole, and therefore it is that I have taken a little more time than usual in obtaining the result. I need not apologise to you, I am sure. You are accustomed to look at these things, and to value them, not for the brilliancy of their appearance, but for their real importance with regard to the subject in hand. Now, this sodium light has, as you will observe, the power of causing a black absorption band, when light, produced at a very intense temperature, is allowed to fall upon the incandescent vapour or flame of the metal at a lower temperature. Those are the conditions under which the absorption band is seen, and the person who first pointed out the real significance of the fact was Kirchhoff. The actual fact was first observed and described by Foucault, and Mr. Stokes suggested an explanation, which turned out to be the true one; but although he divined it, he did not directly prove it by experiment, or publish it to the world, and so make it his own. Kirchhoff, however, not only saw that this sodium vapour absorbed the light of the luminous body behind it, but that in this fact lay the explanation of those remarkable dark lines in the sun's light which, ever since they were first indicated by Wollaston, and carefully examined by Fraünhofer, have been a mystery to all philosophers. The black lines of Fraünhofer are represented in this diagram, which is a repetition of the upper spectrum, *plus* a certain number of black lines which cross it at intervals. The black sodium line has a corresponding black line in the solar spectrum exactly at that part which is marked D. I say "*a* black line." It does, in fact, consist of two lines, which can be discriminated from each other by the use of telescopes of sufficient power.

Now, I desire, if I can, in a few words, to explain to you how this black line is produced. It certainly seems a remarkable thing that the addition of two lights should apparently produce darkness. We know this, however, for a fact in other cases; for light, and in some cases sound, produces the phenomenon of interference, as it is called; but this is not a true case of interference—it is a case of absorption. The spectrum of sodium has the power of absorbing only that thin line of light which it made upon the screen, just as, when we take one of these forks and hold it over the particular box which responds to it, and which absorbs its vibrations, it produces a sound; but the fork produces no sound when held over a second box of different dimensions [holding it over another box]. In the first case, we have a powerful resonance, but there is nothing perceptible from either of these other boxes. Well, this furnishes an analogy—though a rough one—to the way in which the sodium vapour acts in taking up the vibrations which are produced in that particular slice of light from the sodium, appropriating them to the actual raising of its own temperature, and then radiating them out—wholly absorbing them first, and then reradiating them.

How is it that this is a black line? In the black line, as it appears upon the screen, it is true that there is a greater amount of light than the sodium alone could produce, and it is black only by contrast. That part of the spectrum which looked black just now would have appeared bright if seen alone, but as I had a more brilliant spectrum behind it, the light of that spectrum, in falling on the screen, produced upon the eye the effect of a contrast, which led you to believe that the comparatively feebly illuminated sodium line was actually black. That is the cause of the black lines we appear to see in the spectrum of the sun, of the fixed stars, and of a variety of other lights.

I intended to say a word or two upon the composite nature of the solar spectrum before I concluded this part of our subject; but I need not dwell long upon this point, as it has already been insisted upon more than once in the theatre of this Institution. I stated just now that if we obtained the solar spectrum, and examined it—spread it out—we should have a certain amount of light, which we may represent by that band of coloured light which is seen in this diagram. If you notice, you will observe that that coloured stripe is bounded by a curved line above. This is the red end, and here it goes off into the violet. Now, this curve is the result of measurements made very carefully by Fraünhofer for the purpose of ascertaining what is the distribution of light in the different parts of the solar spectrum. A second curve traces the outline of this black mountain, which Dr. Tyndall has been working at, and is intended to indicate the distribution of heat in the spectrum. It is very important to remember that the light given by the sun is but a small portion of the force which it is radiating upon the earth. The portion of the curve filled up with black represents that part where the vibrations are least rapid. Then, when the vibrations increase in rapidity, we get red light. Still more rapid vibrations give us yellow; still more rapid give us green; then we get to the blue and violet. The principal curve in the diagram represents to the eye very roughly, but to a certain extent correctly, the distribution of heat in the visible portion of the spectrum. The heat increases in intensity as we approach to the red, and the light diminishes. The third curve represents the distribution of the chemical rays. If you allow the spectrum from the light of the electric spark taken between points of silver to fall upon the photographic surface of a collodion film, you get a very long strip of light, in which you have a series of the same sort of bands as you have already seen in the luminous portion of the silver spectrum. The vapour of silver gives us a series of interrupted bands, which exert a powerful effect in photographic experiments.

One experiment before I conclude, in order that I may show you the photographic image of the spectra obtained by transmitting a series of powerful electric discharges between wires of the four metals which I spoke of just now. First, the spectrum of silver. There you will see the image prolonged. This is the most refrangible part. The photographic image of the electric spark between wires of silver is five or six times as long as the visible spectrum obtained from silver when heated in the voltaic arc. Here is the photographic spectrum of magnesium, and here is a photograph of the spectrum of thallium. About one-tenth only of the length of any of these spectra is visible to the eye. Finally, here is the photographic spectrum of copper.

PHARMACEUTICAL SOCIETY.

Wednesday, May 15, 1867.

G. W. Sandford, *Esq.*, *President, in the Chair.*

The twenty-sixth annual general meeting of this Society was held on Wednesday, the 15th inst., when the report of the Council was received, and the Council and Audit Committee for the ensuing year were elected. The meeting then resolved itself into a special general meeting, convened for the purpose of taking the sense of the members of the Society relative to the 19th clause in the amended Pharmacy Act. This was one of the largest meetings of members ever held. Mr. Abrahams, of Liverpool, moved, and Mr. Boyce, of Chertsey, seconded, a resolution condemning the policy of applying for an amended Act when the Society was in such a prosperous state. Messrs. Pedlar, Richardson, and others thought that by admitting all chemists without examination they would be doing an injury to those members who had already passed the examinations. After a long discussion, Mr. Collins, of St. Pancras, moved, and Mr. E. Vizer, of Pimlico, seconded, the following amendment:—"That, in the opinion of this meeting, the proposed amendment of the Pharmacy Act is both wise and expe-

dient, as, by enlisting the support of those members of the trade outside the pale of the Society, the way is cleared for carrying into effect the primary objects of the Society— viz., the consolidation of the whole trade, and legislative provision for the compulsory examination of all persons entering the same after a given time. This meeting would further express its entire approval of the action taken by the Council, and pledges itself to support, by all possible means, the passage of the Bill through Parliament." Messrs. Edwards, Squire, Orridge, Morson, Savage, and Randall supported the amendment, which, after considerable discussion, was carried by a large majority.

ACADEMY OF SCIENCES.

May 20, 1867.

(From our Special Correspondent.)

M. Delaunay presented, in the name of M. Camille Flammarion, a note on a change remarked on the surface of the moon in the crater of Linnæus. It is well known that this crater has recently been subjected to an essential modification. The attention of astronomers having been called to this fact by M. Jules Schmidt, of Athens, M. Flammarion chose the moment when the sun rises at the meridian of Linnæus to study this spot. The sun, being only yet elevated a few degrees above the horizon of the crater in question, lit it up very obliquely. The slightest irregularities in the conformation of the surface were most distinctly visible. An attentive observer would remark at once that Linnæus is no more a crater; there is no exterior shadow, no shade in the centre. In its place there is only a cloudy, white, circular spot, or rather a white stain on the ground. Far from being elevated as a crater, it has a greenish colour, like the Sea of Serenity, and seems to be neither in relief nor sunken, but resembles a lake of a lighter colour than the neighbouring plain.

This crater has therefore descended to the level of the plain—fallen in—or else the plain has been raised to about the level of the crater. The interior appears also filled up, for no shadow is distinguishable, whilst smaller craters, such as A and B of Bessel, A and B of Linnæus, and those in the neighbourhood of Posidonius, show the dark shadow very perceptibly. If Linnæus had this aspect at the time when Beer and Maedler laid down their selenographic map, it would have been impossible to have indicated it as a crater. In the map constructed eight years ago by Lecouturier the height is not marked. It appears that it was very deep, ten kilometres in diameter, and that it served as a fixed point for Lorkmann and Maedler.

On May 11, the sun being more elevated, Linnæus presented the same aspect as on the evening before. The evening of the 12th was rainy; the 13th the atmosphere, being very pure, permitted the author to distinguish in the Sea of Serenity a multitude of small disseminated craters. The plain was brilliant, and Linnæus had the same relative brightness.

M. Chacornac, who observed the same things at Lyons, arrived at similar conclusions. Father Secchi, of Rome, has already presented to the Academy his own observations. It is, then, proved for a certainty that a movement has recently taken place in this region of the lunar world. The magnifying power used was 230 to 300 times.

Baron von Liebig read a note "*On an Alimentary Preparation for Replacing Human Milk for Children.*" Human milk of a person in good health contains, per cent., cascine, 3·1; sugar of milk, 4·3; butter, 3·1. Baron von Liebig concluded therefrom that woman's milk contains:—Blood-forming principles, 1 part; heat-producing principles, 3·8 parts. By mixing flour and milk in certain proportions, it is easy to compose a food in which the two nutritive principles are in the same proportion as in human milk—viz., 1 to 3·8. Cows' milk contains, on an average, 4 per cent. of cascine, 4·5 of lactose, 2·5 of butter. If we take, then, 10 parts of milk, 1 part of wheat flour, and 1 part of ground malt, we have a mixture satisfying all the necessary conditions. For preparing this the author recommends the following method:—A mixture is made of 15 grammes of wheaten flour, 15 grammes of ground malt, and 6 grammes of bicarbonate of potash; 30 grammes of water and 150 grammes of milk are then added. The whole is then heated and continually stirred until the mixture begins to thicken. It is then taken off the fire and stirred all the while. After five minutes it is boiled, and then strained through a wire or hair sieve. The ground malt necessary for this preparation is easily furnished by barley malt, obtained at any brewery. It can be ground in a common coffee-grinder, and then passed through a sieve. If this preparation is well made, it is as sweet as the natural milk; it is fluid enough, and keeps for twenty-four hours. In Germany the use of this food is very extensive, and its nutritive qualities are found to be excellent. It has a slight taste of flour or malt, to which children get accustomed—in fact, they soon prefer it to any other food.

M. Charles Robin presented on the part of the family of M. Godard, a work of this doctor entitled "Medical and Scientific Observations made in Egypt and Palestine." This *savant*, who died at Jaffa of a liver complaint contracted at Jerusalem, where he was studying leprosy, founded an annual prize of 1000 fr., already twice awarded by the Academy of Sciences.

M. Paul Thenard announced that M. Michel Perret, by an ingenious process, the result of theory and practical studies, had made a great improvement in the art of making wine. He avoids at the same time acetification, and obtains better colour and more spirit.

This paper was followed by one on chemical researches on the water found in a bronze vase at Pompeii. On the 29th of March last, while making some excavations in a house at Pompeii, a bronze cooking pot was found on an iron tripod. A cover, also of bronze, fitted exactly upon the top of the vase, so that water falling upon it could not penetrate into the interior. On the ground were found three handles, also of bronze, two of which belonged to the vase, and the other, formed of two dolphins, belonged to the cover. They had originally been soldered to the vase and cover. The vessel was found full of water. The diameter of the vase was 15 centimetres, and it was 20 centimetres high. The water was perfectly limpid, and was hardly rendered turbid by a prolonged ebullition with a feeble alkaline reaction. At the temperature of 20° C. its sp. gr. is 1·001, about that of distilled water. The quantity of fixed matters left by evaporation was 1·032 gr. per litre. The gases disengaged by ebullition consisted of air and carbonic acid. Lime and magnesia were found in it; also phosphates in a small quantity; also some traces of sulphates, and even silica and iron. There was not the slightest trace of copper.

NOTICES OF BOOKS.

Chemical Technology; or, Chemistry in its Application to the Arts and Manufactures. By Thos. Richardson, M.A., Ph.D., F.R.S.; and H. Watts, B.A., F.R.S. Second Edition. Vol. I. Part V. London: H. Baillière, 219, Regent Street. 1867.

This second edition of a well-known volume has given an opportunity for several important additions, with an announcement of the parts necessary for the completion of the series.

The work itself has already acquired imposing size, and the complete set forms in itself a library for the manufacturing chemist, who, indeed, could do without it altogether with difficulty, and would incompletely replace it as his book of reference by a great mass of

materials—such a mass, in fact, as must of necessity be consulted by competent chemists for the successful completion of a scheme like this.

The first volume is formed of five parts, each of octavo size, with from 800 to 900 pages. Parts I. and II. contain Fuel and its Applications; Part III., Acids, Alkalies, and Salts; Part IV., Aluminium, Sodium, Phosphorus, Lucifer Matches, Borax, Artificial Mineral Waters, Gunpowder, Gun-cotton, Fireworks, &c.; and the present volume, Part V., Prussiate of Potash, Oxalic Acid, Tartaric Acid, Tartrates of Potash, and Citric Acid, with appendices presently to be noticed. We have thus four handsome books forming Volume I. Volume II. contains Glass, Alum, Potteries, Cements, Gypsum, &c., &c. Volume III., Food generally, Bread, Cheese, Tea, Coffee, Tobacco, Milk, Sugar.

These three volumes are all that have at present appeared; they form six octavo books of large size, illustrated with woodcuts, plates, engravings, and, in the last volume, coloured plates.

The book itself is rich in passages we should like to quote were it not for their length. There is, however, one value connected with a work of this kind which ought to be pointed out. Most young chemists, after passing through the routine course of their scientific education, feel somewhat at a loss to know in what direction to turn their experimental energies, so as to obtain a prospect of some return for their trouble. As we stated in these pages a few weeks ago, it often happens that a difficulty is found in carrying out some manufacture which could easily be overcome, by a short investigation, by a competent chemist; and, indeed, in many cases a difficulty which appears insuperable to the manufacturer, would prove a mere *bagatelle* to the chemist. The difficulty, however, is for the young experimentalist to know what are the problems in industrial chemistry which require solving. In this respect the present series of Chemistry Applied to the Arts and Manufactures constitutes a very mine of wealth. As an illustration, we learn that with regard to the determination of the commercial value of tartars, it is a point of the utmost importance that some method should be devised for ascertaining correctly the quantity of tartaric acid present, which is now merely deduced from the quantity of potash found.

That this method is by no means an accurate one may be seen from the three following analyses of the same sample, viz:—

Tartaric acid present as bitartrate of potash	70·15	69·10	72·25
Tartaric acid present as tartrate of lime	3·35	3·30	3·75
Total crystallised tartaric acid, per cent.	73·50	72·40	76·00

This is so urgent a matter, that one of the largest and most distinguished manufacturers of tartaric acid has expressed his willingness to give 100*l.* as a reward to any one who would discover a satisfactory method of determining, directly, the quantity of crystallisable tartaric acid present in tartars, in a sufficiently ready manner to be applicable to commercial analysis. This is only one of the many chemical problems to be met with throughout the work, the solution of which would be attended with considerable profit.

The following are announced as in preparation to complete the work:—Vol. IV. devoted to Liquid Food, Ales, Wines, Spirits, &c.; V. and VI. to Textile Manufactures, Cotton, Wool, Silk, &c.; VII. to the Manufacture of Leather, Gutta Percha, &c.; VIII. to Manufacture of Paper, &c.; IX., X., XI., to Metallurgy and Chemistry of the Metals; XII. to the Manufacture of Colours, Oils, and Varnishes. These will complete an elaborate and exhaustive work, which English chemists will mention with pride, as a proof of the repute in which chemistry is beginning to be held in our country. It seems that no space will be given separately to the consideration of the preparation of medicinal substances in a pure form, such as morphia, chloroform, &c.

As regards this present edition of the volume under notice, no one will doubt the wisdom of the retention of the older notation of the former one, which is still most applicable to the wants of the manufacturer, who cannot be expected to be well acquainted with the newer views held in 1867. The next edition will be in time for those of a younger generation now pupils at various laboratories.

Of the 900 pages of this part, upwards of 700 are devoted to the various appendices. Appendix A consists of additions to the various chapters of Vol. I., parts iii., iv., and v., first edition, and brings the report up to the present time; nearly 300 pages are devoted to this part of the work. Appendix B contains abstracts of specifications of patent inventions relating to materials and processes described in those same parts; Appendix C (of the greatest value), tables connected with the processes described in the former parts; Appendix D, documents relating to the Patent Laws, appearing at a very opportune time. A casual glance will show a great part of the value of all these appendices, but Appendix C is so important, and would be so useful for constant reference, that we would urge a publication of it separately; it would form a volume more easy for constant reference than in its present the form. Lastly, we think that the whole of the additions to the first edition, which form the bulk of the book, ought with justice to be prepared also in a separate form. Possessors of the first edition should not be expected to buy the whole volume, part of which they already possess. The same reason should have weight with the publishers, when the time comes for newer editions from time to time. If this were promised, the different parts would have a lasting value even to a greater extent than at present; besides this, the latest information could be more frequently supplied, to supply a more extensive demand. The plates, five in number, are excellent; two of them consist of tables and scales, the other three of apparatus, &c. It would have been better if the paper for these had been of a stronger kind, or mounted on some material to make them more durable for frequent reference. We commend a consideration of this point to Messrs. Richardson and Watts for discussion in the forthcoming volumes relating to textile manufactures and the manufacture of paper.

"Chemical Technology," clearly and accurately written, neatly sent to press, and very moderate in price, may justly be a source of pride to the authors, the publisher, and the profession generally.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Annales de Chimie et de Physique. March, 1867.

F. P. Le Roux "*On the Relative Position of the Planes of Vibration of Incident, Reflected, and Refracted Rays in Isotropic Media.*"—Bontemps: "*Remarks upon J. Pelouze's Memoir on Glass.*"—F. P. Le Roux "*On the Effects of Annealing on the Colour of Glass.*"

Archives des Sciences. February 25, 1867.

G. De Saporta "*On the Temperature of Geological Periods as deduced from an Examination of Fossil Plants.*"—V. Fatio "*On the Presence of Air in the Bodies of Birds.*"—H. Dor "*On Max Schulze's Researches on the Yellow Spot of the Retina, and its Influence on Normal Vision and on Colour Blindness.*"—C. Muller: "*Researches on the Position of the Alkaloids in Cinchona Bark.*"

Comptes Rendus. April 2.

M. E. Chevreul: "*Note on two Works on Alchemy attributed to Artefius and Alphonso X.*"—Daubrée: "*A new Method of Studying the Structure of Meteorites.*"—H. Dufresne: "*A new Method of Gilding and Silvering by Amalgamation, without Danger to the Workmen.*"—J. M. Crafts "*On the Arsenic Ethers.*"—P. Hautefeuille "*On some Inverse Reactions.*"—L. Joulin "*On the Potash and Soda of Stassfurt.*"—Berthelot "*On a Method of Reducing and Saturating Organic Compounds with Hydrogen.*" A. Civiale "*On the Application of Photography to Physical Geography and Geology.*"—Jolyet "*On the Action of Sulphate of Quinine on Frogs.*"—J. Rambosson "*On the Influence of Food on the Nervous System.*"—C. Hofmann: "*Experiments on Cutaneous Absorption.*"—J. Smyth "*On the Presence of Ozone in the Atmosphere.*"

Monatsbericht der königlich-Preussischen Akademie. November, 1866.

A. W. Hofmann "*On the Transformation of the Aromatic Monamines into Acids containing a larger Proportion of Carbon.*"—A. Baeyer "*On the Constitution of Mellitic Acid.*"—E. O. Erdmann "*On the Origin of the Blood-red Colour which occasionally appears on Articles of Food.*"

Bulletin de l'Académie de Belgique. February 2.

A. Kekulé: "*Report on Montigny's Memoir on the Correlation of the Refractive and Calorific Powers of certain Substances.*" — Plateau: "*Report on the same Memoir.*"

NOTICES OF PATENTS.

2077. *Making Caustic Soda from Common Salt, by the Action of Lead or its Oxide, with After Recovery of the Lead for further Use.* S. Rowbotham, Penkett, near Warrington. August 14, 1866.

The sodic chloride is either fused with the lead or mixed with plumbic oxide and water until decomposition takes place. Heat may or may not be necessary; the whole is kept moist by steam. The caustic soda is separated by lixiviation. The plumbic chloride left is then exposed to the action of oxygen with heat, or steamed to recover the lead or its oxide. The lead is further to be purified by the action of charcoal.—Patent abandoned.

2095. *Coating and Recovering Metals from Chlorides and other Solutions of Metals.* J. Webster, Birmingham. August 15, 1866.

Chiefly applied for using the zinc chloride in the flux used in the pots for galvanising iron. This is boiled in a cast-iron vat; when the temperature reaches 600° Fahr., scraps of tin or wrought iron from other manufactures are added. The vat has a longitudinal partition, which is a grating or perforated plate to allow of free diffusion; in one half the scrap tin or iron is placed, in the other articles that require a coating of zinc or tin. In this also scrap materials must be placed and pressed on the bottom of the vat by another perforated iron plate for the hydrogen gas to escape. Copper, brass, &c., by such a coating of zinc or tin, are protected from atmospheric action.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

1107. C. Crockford, Holywell, Flintshire, "Improvements in obtaining useful products from certain materials produced in the process of galvanising or coating iron with zinc."—Petition recorded April 13, 1867.

1118. The Rev. J. Oakden, St. Stephen's Parsonage, Congleton, and J. Picking, Dane Row, Buglawton, Congleton, "A new or improved enamel for enamelling metals and stones, to prevent rust, corrosion, and incrustation." April 15, 1867.

1190. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the treatment of peat, and in the manufacture of peat charcoal, and in the machinery or apparatus employed therein." A communication from A. Figge, Hanover.—April 24, 1867.

1198. C. E. Brooman, Fleet Street, "A new or improved process of destroying vegetable matters in wools, noils, woollen waste, and rags." A communication from C. Schaller, Bischweiler, France.

1200. C. E. Brooman, Fleet Street, "A new or improved process of preserving meat, fish, and other substances." A communication from F. Cirio, Turin, Italy.—April 25, 1867.

Notices to Proceed.

935. J. Bird, Seymour Street West, Connaught Square, Middlesex, and J. Bird, Laurence Pountney Hill, London, "Improvements in the manufacture of artificial fuel."—Petition recorded March 29, 1867.

952. W. E. Newton, Chancery Lane, "An improved process for manufacturing ice, and for other refrigerating purposes." A communication from T. S. C. Lowe, New York, U.S.A.—March 30, 1867.

1042. W. Henderson, Glasgow, "Improvements in oxidising minerals, ores, and metals; in reducing oxides of metals; in separating certain metals from each other; in kilns, furnaces, or other apparatus for these purposes; and in the treatment of the products obtained therefrom."—April 6, 1867.

1153. W. Harrison, Wharton Green, Winsford, Cheshire, "An improved method of consuming smoke in furnaces."—April 20, 1867.

CORRESPONDENCE.

Transparency of Red-hot Metals.

To the Editor of the Chemical News.

Sir,—One of the contemporaries, though not a strictly scientific periodical, of your valuable paper, calls attention to a highly curious and startling fact observed and communicated by the reverend and highly eminent *savant*, Father Secchi, of Rome, concerning the transparency of iron while red-hot. The fact that iron, steel, and also platinum and copper, are transparent while at a bright red heat, has been known long since not only to practical engineers, but, as regards iron, steel, copper, and platinum, to workers in these metals. The account given of the manner in which the excellent member of an eminent society found out this property of iron is as follows:—The reverend Father had ordered a strong iron tube to be made. As it was intended for an apparatus requiring a vacuum, it was essential that this tube should be perfectly air-tight; and as Father Secchi had some doubts about its soundness in this respect, in order to set these at rest the tube was made red-hot and taken into a dark place, when Father Secchi clearly perceived through the iron, which was half a centimetre thick, a crack inside the tube, and which did not reach to the outer surface. It is rather curious that the fact of the metals above alluded to, to which I have reason to believe that gold may be added, becoming transparent at red heat should have escaped the notice of scientific men. It requires, however, a good bright red heat; but the transparency of the metals is evident thus even in daylight, as I know from my own experience while working in an engineering establishment attached to a large sugar refinery, now many years ago.

I am, &c. A. Adriani.

[The above statements are so much at variance with all previous ideas on the subject, that much stronger evidence will be required before the transparency of red- or white-hot metals can be accepted as proved.—Ed. *C. N.*]

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Cyanin (C = 12).—Dr. G. Nadler and Dr. V. Merz. The cyanin, or chinoline blue, which forms the subject of this paper, was prepared from tolerably pure chinoline, and was, therefore, an amylchinoline derivative. Chinoline blue, or iodocyanin, $C_{28}H_{35}N_2I$, is almost insoluble in ether and cold water, rather soluble in hot water, sparingly so in cold alcohol, and very soluble in hot alcohol; the green crystals melt and lose water at 100°; their solution in alcoholic solution of nitric acid is precipitated by argentic nitrate. Iodocyanin is capable of uniting with one or two molecules of acids; its solution in chlorhydric acid, if allowed to evaporate spontaneously in presence of lime, deposits colourless crystals, $C_{28}H_{35}N_2I,2HCl$, which lose HCl at 90—100°. A warm alcoholic solution of iodocyanin digested with fresh argentic oxide gave cyanin $C_{28}H_{36}N_2O$. A chlorhydric acid solution of cyanin precipitated by ammonia, or an alcoholic solution of iodocyanin digested with argentic chloride, gives chlorocyanin, $C_{28}H_{35}N_2Cl$, easily soluble in alcohol and hot water, sparingly so in ether and cold water, combining with acids to form colourless compounds. Nitrato-cyanin was prepared by precipitating an alcoholic solution of iodocyanin, acidulated with nitric acid, with argentic nitrate; it is slightly soluble in ether and cold water, easily so in alcohol; its formula is

$$\left.\begin{matrix}C_{28}H_{35}N_2\\NO_2\end{matrix}\right\}O;$$

it combines with acids to form colourless bodies; treated with ammonic sulphide at 100°, $C_{56}H_{68}N_4S_3O_2$ was obtained. Iodocyanin, heated with concentrated sulphuric acid, gave sulphatocyanin—

$$\left.\begin{matrix}2C_{28}H_{35}N_2\\SO_2\end{matrix}\right\}O_2,$$

which, air-dried, is a light brown body, which decomposes, without melting, at 120°. From it other similar bodies, such as oxalocyanin,

$$\left.\begin{matrix}2C_{28}H_{35}N_2\\C_2O_2\end{matrix}\right\}O_2,$$

are obtainable.

It appears from the above that cyanin is capable of forming with acids three kinds of bodies—the monacid bodies are intensely coloured, the triacid compounds are colourless and easily decomposed, giving rise to diacid compounds. All the coloured compounds are unstable in sunlight.—(*Journ. prakt. Chem.* c. 129.)

Oxalohydroxamic Acid (C=12).—H. Lossen. This is one of two acid bodies formed by the action of hydroxylamine on ethylic oxalate; it is very difficultly soluble in cold water, but crystallises from boiling water; it explodes at 105°; dried over sulphuric acid it contains $C_2H_4N_2O_4$, which formula, however, may need to be tripled. Its salts are generally insoluble, or sparingly soluble, in water, and explode if heated to 130° or 180°, or if put into concentrated sulphuric acid. The constitution of the acid is probably expressed by

$$\left.\begin{matrix}C_2O_2\\(HO)_2\\H_2\end{matrix}\right\}N_2$$

(*Zeitschr. Chem.*, N. F., iii. 129.)

Sarcolactic Acid.—O. Schultzen. The urine of men or animals that have been poisoned by phosphorus, when the poisoning has reached the stage of colouring the skin, contains large quantities of this acid. To extract it the urine was evaporated to syrupy consistence, the alcoholic extract of the syrup was evaporated, the residue was treated with sulphuric acid and ether, the ether was decanted, and the substance left on its evaporation was purified by a small quantity of plumbic acetate freed from lead by sulphhydric acid, and from acetic acid by evaporation; sarcolactic acid remained, which was identified by analysis of the zincic, cupric, and calcic salts.—(*Zeitschr. Chem.*, N. F., iii. 138.)

Bichlorsulphobenzide (C=12).—R. Otto. This body—

$$\left.\begin{matrix}C_6H_4Cl\\C_6H_4Cl\end{matrix}\right\}SO_2$$

is easily obtained by the action of chlorobenzol on sulphuric anhydride. It is insoluble in water, and crystallises from hot alcohol in long white needles, melting at 140—141°.—(*Zeitschr. Chem.*, N. F., iii. 143.)

Chlorbenzolsulphuric Acid (C=12).—R. Otto. This acid is a by-product in the preparation of bichlorsulphobenzide. It is obtainable in long white asbestos-like deliquescent needles, fusible in the water oven, easily soluble in water and alcohol, insoluble in ether and benzol. It is monobasic—

$$\left.\begin{matrix}C_6H_4Cl\\SO_2\\H\end{matrix}\right\}O.$$

Its salts are mostly soluble in water, and may be heated to 200° without decomposition. The sodic, potassic, calcic, baric, plumbic, cupric, and ethylic salts are described.

The chloride

$$\left.\begin{matrix}C_6H_4ClSO_2\\Cl\end{matrix}\right\}$$

is easily obtained by acting upon sodic chlorbenzolsulphate with phosphoric pentachloride. It is soluble in ether, benzol, and alcohol; insoluble in water. It forms magnificent four-sided rhombic tables, often of considerable dimensions. It melts at 50—51°. With alcoholic solution of ammonia, sulphochlorbenzolamide is formed,

$$\left.\begin{matrix}C_6H_4ClSO_2\\H_2\end{matrix}\right\}N,$$

crystallising from water in four-sided rhombic pillars of large size. It melts at 143—144°. By acting on chlorbenzolsulphuric chloride with zinc and sulphuric acid, chlorphenylsulphhydrate is obtained,

$$\left.\begin{matrix}C_6H_4Cl\\H\end{matrix}\right\}S,$$

which forms superb crystals, melting at 53—54°, distilling undecomposed, insoluble in water, soluble in ether and alcohol. It combines with mercuric chloride to form a compound insoluble in boiling water or alcohol, and gives with nitric acid chlorphenylic sulphide,

$$\left.\begin{matrix}C_6H_4Cl\\C_6H_4Cl\end{matrix}\right\}S_2,$$

insoluble in water, easily soluble in hot alcohol, ether, or benzol, melting at 71°, and distilling undecomposed.

Chlorbenzolsulphurous acid results from chlorbenzolsulphuric chloride under the influence of sodium amalgam. It crystallises in small rhombic needles, easily soluble in hot water and alcohol, melting at 88—90°. The sodic, calcic, plumbic, and ethylic salts are described. Its formula is

$$\left.\begin{matrix}C_6H_4Cl\\SO\\H\end{matrix}\right\}O.$$

—(*Zeitschr. Chem.*, N. F., iii. 144.)

Organic Acids, a New Series of (C=12).—P. Griess. Diazobenzoic perbromide (*Ann. Chem. Pharm.* cxxxv. 121), in solution of ammonia, decomposes with formation of $C_7H_5N_3O_2$, easily soluble in alcohol and ether, difficultly so in boiling, insoluble in cold water, melting at about 160°; it forms definite salts. The argentic salt is a white amorphous precipitate, $C_7H_4AgN_3O_2$. Analogous acids are formed by the action of ammonia on diazodracylic and diazosalylic perbromides. Diazoanissic and diazohippuric perbromides react in a similar manner. The reaction is therefore general.—(*Zeitschr. Chem.*, N.F., iii. 164.)

Ethyl- and Diethyl-benzol, Products of Oxidation of (C=12.)—R. Fittig and J. König. Ethylbenzol is easily oxidised by dilute nitric acid, benzoic acid with traces of a nitro-acid being produced. Monobromethyl-

benzol gave by oxidation bromdracylic acid identical with that obtained by Hubner and Philipp from bromtoluol. Diethylbenzol, treated with potassic dichromate and sulphuric acid, gave terephthalic acid, but, if oxidised with dilute nitric acid, an acid isomeric with xylylic acid is produced, and which may be called ethylbenzoic acid,

$$C_6H_4 \begin{cases} CO_2H \\ C_2H_5. \end{cases}$$

It crystallises from water or alcohol, and melts at about 110°. The baric, calcic, argentic, and cupric salts were analysed. This acid differs from all others of similar constitution. It may be regarded as bromdracylic acid, in which Br is replaced by ethyl; and it will perhaps be identical with an acid which Kekulé hopes to obtain by the action of bromethylbenzol on sodium and carbonic dioxide. The production of bromdracylic acid above mentioned proves that in bromethylbenzol the same H atom in the benzol residue is replaced by bromine, as is the case in bromtoluol.—(*Zeitschr. Chem.*, N. F., iii. 167.)

Opium, Alkaloids of: their Separation.—M. Kubly. The substance to be examined is extracted with benzol; narcotine, papaverine, thebaine, and codeine, are dissolved. Amylic alcohol dissolves morphine from the residue, and alcohol will extract narceine, if present in what is left undissolved by the two former solvents. To separate the four alkaloids soluble in benzol, cold amylic alcohol is used, which dissolves codeine; very dilute acetic acid will then extract papaverine and thebaine from the narcotine which remains. Finally, thebaine is precipitated from the sulphuric acid solution of papaverine and thebaine by bismuthic iodide in potassic iodide solution, papaverine remaining in solution.—(*Pharm. Journ. Russ.* Nov. 1866, 457.)

MISCELLANEOUS.

Quinine.—The *Homeward Mail* reports a singular affair which has just occurred at Calcutta. Under the Indian Patent Act, every exclusive privilege must cease if the Governor-General of India in Council shall declare that the same is generally prejudicial to the public. This has accordingly been done in the case of a petition filed by W. G. M'Ivor, who wishes for a patent for an alleged new invention for producing and preparing the different species and varieties of cinchona bark for the manufacture of quinine, quinidine, cinchonidine, and other alkaloids.

Alum Crystallisations over Fresh Flowers.—Make baskets of pliable copper wire, and wrap them with gauze. Into these tie to the bottom violets, ferns, geranium leaves, chrysanthemums—in fact, any flowers except full-blown roses—and sink them in a solution of alum of one pound to the gallon of water, after the solution has cooled, as the colours will then be preserved in their original beauty, and the crystallised alum will hold faster than when from a hot solution. When you have a light covering of distinct crystals that cover completely the articles, remove carefully, and allow them to drain for twelve hours. These baskets make a beautiful parlour ornament, and for a long time preserve the freshness of the flowers.—*W. P. Creecy*, in the *Am. Journ. Pharmacy*.

Estimation of Silver in a Metallic State.—According to M. Classen, silver is wholly precipitated by cadmium; when dealing with a nitric solution of silver, evaporate to dryness in the presence of sulphuric acid, dissolve the sulphate of silver in boiling water, plunge into it a plate of cadmium, and the reduction of the silver takes place at once. The silver is deposited in a compact mass, easily washed with water; as it may contain a little cadmium, boil it in the acid liquid until no hydrogen escapes; wash it until the water contains no sulphuric acid; then dry, and calcine; the silver, at first a black grey, takes the metallic lustre; it may then be weighed:—the results are very exact.

NOTES AND QUERIES.

Map Varnish.—Sir,—J. S. will find that he can make a very good varnish for covering over architectural and mechanical drawings, maps, &c., by dissolving one pound of white shellac, a quarter of a pound of camphor, and two ounces of Canada balsam in one gallon of alcohol.

Map Varnish.—Sir,—I beg to place the following recipe at the service of "J. S.," who wishes to know how to prepare a good quick-drying map varnish:—Thin down with turpentine Canada balsam, and add one-fourth of the bulk of quick-drying pale copal varnish; lay on smoothly with a flat camel-hair brush, and let the map lie flat for a few hours.—Thos. Bournes.

Artificial Teeth.—In reply to the inquiry from F. T., Leeds, in our last number, we have received several letters. They have been forwarded as requested.

Chinese Blue.—Sir,—Will you oblige me by notifying that you wish to receive communications for a subscriber on the subject of Chinese blue from the same or others who replied to R. H. W., of Manchester? Information of value would be paid for.—Wm. Schofield.

Palm Oil.—Sir,—If any of your correspondents will inform me how much chrome is necessary to bleach a cwt. of palm oil, they will confer a favour on yours, &c., Milo.

Santonine.—Sir,—Can any of your readers favour me with some good directions for mounting santonine for the microscope so as to obtain good polarising crystals?—F. Cooper.

Letters are waiting at our Office for F. T., Leeds; R. E. B., Manchester; H. P. Meaden; J. K. M.; Manufacturer.

ANSWERS TO CORRESPONDENTS.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. od., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

*** Owing to press of matter, we are obliged to defer an article by D. Forbes, F. R. S., on the Blowpipe, a paper by Professor Church on the Benzol Series, a verbatim report of Dr. Odling's lecture delivered at the Royal Institution last Friday, and several reviews, letters, &c. Up to the time of going to press the Abbé Moigno's weekly letter had not arrived.

James Y.—The term iodide of calomel is retained in American pharmacy for a mixture of iodide and chlorides of mercury, prepared by mixing iodine with calomel. According to the same barbarous nomenclature, there is a biniodide of calomel.

Butter.—You are mistaken in supposing that only rancid butter contains butyric acid. Fresh butter contains a compound of butyric acid with glycerin, which is inodorous; and it is to the decomposition of this compound on standing, by which butyric acid is set free, that the flavour of rancidity is due.

A Student will find full information on the subject of the atomicity of radicals in Wurtz's "Introduction to Chemical Philosophy," page 104, *et seq.*

M. R.—The office where the hot-air engine, described in our last number, may be seen, is 531, Oxford Street.

Kappa.—You will find all you require in Griffin's "Chemical Handicraft."

Constant Reader.—Are you sure you deserve that name? An article giving all the information you inquire for appeared only three numbers ago.

P. McPherson.—Heavy hydrocarbon oils containing no naphtha are convertible into oils of the naphtha series under the action of heat.

The Chemical Society.—One who has been on the Council; A Blackball; F. C. S.; A Country Member; F. J., Wolverhampton; and others.—We think no good will be gained by continuing the discussion. The matter is occupying the serious attention of the Council, and our correspondents may rest satisfied that the decision at which they arrive will best serve to place matters on a permanent healthy footing.

An Old Subscriber.—The lecture referred to is published in the *Journal of the Chemical Society*. Richardson and Watts's "Technology" gives an excellent account of the alkali manufacture.

Communications have been received from D. Forbes; S. Mellor; H. Gillman; C. W. Heaton; Sir B. C. Brodie; G. Foord; Clayton and Co.; F. Barnes; O. Solomon; M. Williams; W. Johnstone; Professor Angelo Pavesi; C. F. Burnard (with enclosure); Robert Bell (with enclosure); J. H. Swindells (with enclosure); William Allen; James Kayen; Thomas Bournes; H. Sugg; W. Perkin; A. H. Church.

Books Received.—"On a New Process for Preparing Meat for Weak Stomachs," by W. Marcet, M.D., &c.; "Shaw's Medical Remembrancer," by Jonathan Hutchinson, F.R.C.S.

IDEAL CHEMISTRY.

On Thursday next the Fellows of the Chemical Society will assemble at Burlington House to hear a lecture by Sir Benjamin Brodie on the new Chemical Calculus. The subject is perhaps the most abstruse which has ever been brought before the Society, and it has, therefore, been considered advisable for us to give in the present number a slight outline of the methods of reasoning adopted by the learned author, as set forth in the paper* which has just appeared in the *Philosophical Transactions*.

The memoir, of which the first part is the subject of this article, will mark a new epoch in that branch of chemical science which relates to the symbolic expression of facts. The complete paper is not yet published. The present part, which was read before the Royal Society on May 3, 1866, when it attracted the liveliest attention, and some little discussion from the chemists present, relates to the construction of chemical symbols. In the second part the author proposes to treat of the theory of chemical equations, which is intimately connected with the general processes of chemical reasoning, and especially with the consideration of the nature of that event which is termed a chemical change, of which a new analysis will be given founded on its symbolic expression. In the third part it is intended to consider the principles of symbolic classification, and the light thrown by this method upon the origin and nature of the numerical laws which limit the distribution of weight in chemical change.

The author mainly confines himself at present to the discovery of a system of symbolic expressions by which the composition of the units of weight of chemical substances may be accurately represented, and which may hereafter be employed for the purposes of chemical reasoning. This problem is of a perfectly real nature, admitting, where the experimental data are adequately supplied, of only one solution; and the discussion of this question involves the consideration of the fundamental principles of symbolic expression in chemistry.

In the first section, considerable attention is devoted to the definitions, and the various terms used have definite significations attached to them. "Ponderable matter" and "a chemical substance" require no explanation, but the expression "a weight" is used in a special sense. In this discussion every chemical substance, simple or compound, is exclusively regarded as a *weight* of matter. Its form, condition, or state is disregarded, and the only property with which the chemist has here to do is the transformation of the weights of matter, and the laws of the composition and resolution of these weights. The term *a weight* is used, therefore, in a concrete sense, as when we speak of "a box of weights," and call one of the pieces of metal in the box "*a weight*" of platinum or brass. In just this sense, Sir Benjamin Brodie speaks of *a weight* of water, of oxygen, of sulphur, &c., excluding all other forces but that of gravitation.

A "single weight" is a weight of any portion of matter regarded as one object. The matter making up this weight may be simple or compound, and, if the latter, chemically combined or not. So long as it is considered as one object, it is a single weight.

A "group of weights" is constituted of any number of single weights.

Between two portions of ponderable matter (two "weights") there may be *equality* and *identity* as regards weight. These terms require fuller explanation. Take a *weight* of water—a gramme, for instance—and apply heat to it; it increases in bulk; it becomes a gas; and at a still further elevation of temperature it is resolved into its components, oxygen and hydrogen. But throughout all these profound physical and chemical changes, its action on the balance does not vary. Now, there is the relation of *equality* of weight between a gramme of water and a gramme of oxy-hydrogen gas, as there is between a gramme of water and a gramme of lead. But the gramme of water is connected with the gramme of its component gases by another relation, that of continuity of existence, or *identity*, which does not exist between the gramme of water and the gramme of lead.

A compound weight is here defined as a single weight of which the whole is identical with two or more weights. Such weights are termed the components of the compound weight, which is said to be composed of them. A "simple weight" is a weight which is not compound—that is, which has only one component.

It is necessary to select a "unit of ponderable matter" which may serve as the common measure of those chemical properties which it is desired to investigate, and in this investigation the "unit" is defined as that portion of gaseous ponderable matter which occupies the volume of 1000 c.c. at 0° C., and a pressure of 760 m.m. of mercury. This volume is called the "unit of space," and the weight of a unit of hydrogen is selected as the standard. The weights of other units of matter can therefore be expressed absolutely in grammes, or relatively in reference to the standard unit of hydrogen.

When a compound weight (*e.g.*, a weight of water) is resolved into its component weights (*e.g.*, a weight of oxygen and a weight of hydrogen), the weight is said to be "distributed." The same expression is used in reference to the converse operation of synthesis. The meaning of the term "undistributed weight" follows from the above. A distributed weight is necessarily a compound weight, and an undistributed weight must be regarded, in respect to the events under consideration, as simple, although under other circumstances it might prove to be a compound weight.

A chemical operation is defined as an operation performed on the unit of space of which the result is *a weight*. These chemical operations are represented by symbols $x, y, \ldots$. The symbol + is the symbol of the operation by which one weight is added to another to constitute with it one group. The symbol − represents the removal of a weight from a group of weights. The symbol = is the symbol of identity. The symbol $x + y$ represents a group constituted of the two weights A and B; $x + x$, or $2x$, is the symbol of two weights A; and $x - y$ is the symbol of the weight A without the weight B. The symbol o is the symbol of a group in which no weight appears, and which has had its origin in the several performances of the operations x and $-x$; so that $x - x = o$, and $o + x = x$. The symbols +, −, and = are here used in a sense analogous to their arithmetical meaning. No uniform interpretation has hitherto been attached to them in chemistry.

But the most important feature of the method is the introduction of the symbol xy as the symbol of a compound weight, of which two portions of matter, say A and B, are the component weights. This symbol indicates that we are to perform the operation y upon the unit of space, and then to perform successively upon

* "*The Calculus of Chemical Operations; being a Method for the Investigation, by Means of Symbols, of the Laws of the Distribution of Weight in Chemical Change,*" by Sir Benjamin C. Brodie, Bart., F.R.S., Professor of Chemistry in the University of Oxford.

that *same* unit the operation x, in which respect it differs from the symbol $x+y$, which indicates that the operations are to be performed upon distinct units, the results being different, according as the operations are performed *successively*, *jointly*, *severally*, or *collectively*. The symbol xy is the symbol of the *successive* operations x and y; (xy) represents their *joint* operations; $x+y$ represents them operating *severally*; and $(x+y)$ represents the same operations operating collectively. We can thus express with accuracy the various ways in which we conceive of the existence of the same ponderable matter.

The symbol 1 is necessarily contained as a common factor in every chemical symbol, and is the symbol of the common subject of operation, the unit of space. But the unit of space, as above explained, is space without weight, and the symbol 1 is therefore the symbol of "no weight." It is therefore inferred that $0=1$. This equation may at first sight appear paradoxical; it need not, however, be a matter of surprise that in the chemical calculus we should have two symbols for "no weight," since in that system the same ponderable matter may be denoted by xy and $x+y$. These different symbols are necessary, as representing the different ways the "weight" or the "no weight" has been obtained. Similarly, the symbol ∞ is to be interpreted as the symbol of the ponderable universe regarded as a whole, and the symbols 1 and ∞ represent in the calculus of chemistry the limits between which the values of all other symbols are comprised.

Now, according to the definition given of chemical identity, two weights are said to be identical which consist of the same weights; hence the weight (or matter) of which xy is the symbol is identical with the weight (or matter) of which $x+y$ is the symbol; and

$$xy=x+y.$$

This equation is the fundamental equation of the Calculus, and from it the properties of the symbols are derived.

After a discussion of the fundamental chemical equations, the symbols of simple weights (which are termed prime factors), and the construction of chemical equations from the data afforded by experiment, the author proceeds to the symbols of the units of chemical substances. One hypothesis is assumed, and that is that the unit of hydrogen is a simple weight. The symbol of this "weight" is expressed by the letter α. The absolute weight of the portion of ponderable matter thus symbolised—that is to say, of 1000 c.c. of hydrogen at 0° C. and 760 m.m. pressure—is 0·089 grm. This is identical with the "crith" of Dr. Hofmann. It is subsequently shown that the units of the elements mercury, zinc, cadmium, and tin may be symbolised in an equally simple manner. The author employs letters of the Greek alphabet as symbols of simple weights. Speaking of this, he says, "It is a mistake to confuse the objects of a symbolic system with those of a 'memoria technica,' and I am inclined to believe that a purely accidental distribution of letters among the weights to be expressed would be the best. In the selection here made, however, I have not proceeded rigidly upon this principle, a certain reminiscence of the name being retained in the symbol, as for example the ξ of *ὀξύς*, the θ of *θεῖον*, the χ of *χλωρός*, and the δ of *ὑδράργυρος*. Facility of writing and reading the symbols is, however, far more important than any aid to memory which can be thus afforded, and these points are to be mainly considered. The unit of hydrogen, which occupies a peculiar position as the 'modulus' of the system, is indicated by a special symbol α."

It is known by experiment that 2 units of water can be decomposed into 2 units of hydrogen and 1 unit of oxygen. Now, let

$\alpha^m\xi^{m_1}$ = symbol of the unit of water,
α = symbol of the unit of hydrogen,
$\alpha^n\xi^{n_1}$ = symbol of the unit of oxygen,

where α and ξ are the symbols of simple weights, and m, m_1, n, n_1 positive integers. Then

$$2\alpha^m\xi^{m_1}=2\alpha+\alpha^n\xi^{n_1}$$

To this is attached the condition that

$$w(\alpha)=1,$$
$$m+m_1w(\xi)=9;$$

from the fundamental equation

$$(\alpha^m\xi^{m_1})^2=\alpha^2\alpha^n\xi^{n_1},$$

whence

$$2m=2+n \text{ and } 2m_1=n_1.$$

Selecting from the possible solutions of these equations the minimum solution as both necessary and sufficient to satisfy the condition of the equation, we have

$$m=1,\quad n=0,$$
$$m_1=1,\quad n_1=2,$$

which give

Symbol of water, $\alpha\xi$;
Symbol of oxygen, ξ^2;

the relative weights corresponding to the prime factors α and ξ are

$$w(\alpha)=1,$$
$$w(\xi)=8,$$

the equation being thus expressed:—

$$2\alpha\xi=2\alpha+\xi^2.$$

The following table is given of the combinations of the prime factors α and ξ:—

Name of substance.	Prime Factors.	Absolute weight in grammes.	Relative Weight.
	α	0·089	1
	ξ	0·715	8
	Symbol.		
Hydrogen . . .	α	0·089	1
Oxygen	ξ^2	1·430	16
Water	$\alpha\xi$	0·805	9
Peroxide of hydrogen	$\alpha\xi^2$	1·520	17

By a similar process of reasoning, starting from the ascertained facts that the density of sulphur vapour is 32, that of hydrogen being 1, and that the ponderable matter of 2 units of hydrogen is identical with the ponderable matter of 2 units of hydrogen and 1 unit of sulphur, it is shown that the symbol of sulphur is θ^2, and that of sulphuretted hydrogen $\alpha\theta$. The symbol of sulphuric acid $\alpha\theta\xi^4$, and that of pentathionic acid $\alpha\theta^5\xi^6$. Similarly, selenium is symbolised as λ^2, seleniuretted hydrogen becoming $\alpha\lambda$.

In the case of chlorine, which may be taken as the representative of another group of elements, it is ascertained that 2 volumes of hydrochloric acid can be decomposed into 1 volume of hydrochloric acid and 1 volume of chlorine.

Hence, putting $\alpha^m\chi^{m_1}$ as the symbol of the unit of hydrochloric acid, and $\alpha^n\chi^{n_1}$ as the symbol of the unit of chlorine,

$$2\alpha^m\chi^{m_1}=\alpha+\alpha^n\chi^{n_1},$$

and

$$(\alpha^m\chi^{m_1})^2=\alpha\alpha^n\chi^{n_1};$$

whence

$$2m=1+n$$
$$2m_1=n_1$$

and

$$m=1, \quad m_1=1$$
$$n=1, \quad n_1=2,$$

a minimum.

Since the density of hydrochloric acid is 18·25, we have to determine the absolute weight of the simple weight χ,

$$m+m_1w(\chi)=18{\cdot}25,$$

whence

$$w(\chi)=17{\cdot}25,$$

which gives the

Symbol of hydrochloric acid $\alpha\chi$,
Symbol of chlorine . . $\alpha\chi^2$.

We can only briefly allude to the discussion of the symbols of carbon, silicon, and boron. Owing to the impossibility of ascertaining the vapour densities of these elements by direct experiment, their symbols cannot be determined in an analogous manner to those of the preceding elements; but inasmuch as we are able to construct numerous chemical equations which connect the vapour densities of carbon, silicon, and boron with known vapour densities, we are able to determine from these, within certain limits, the symbol of the elements themselves.

From such data as these it is rendered very probable that the symbols of carbon, silicon, and boron are respectively of the terms

$$\kappa^\nu, \ \sigma^\nu, \ (\alpha\beta^2)^\nu.$$

In the case of the elements antimony, bismuth, tin, zinc, cadmium, and silver, different principles of investigation have to be adopted, and their symbols are given according to two or more hypotheses.

The following table of the symbols of the units of certain well-known substances affords sufficient illustration of the method pursued:—

Symbol of	iodine	$\alpha\omega^2$
,, ,,	bromine	$\alpha\beta^2$
,, ,,	nitrogen	$\alpha\nu^2$
,, ,,	phosphorus	$\alpha^2\phi^4$
,, ,,	arsenic	$\alpha^2\rho^4$
,, ,,	chloric acid . . .	$\alpha\chi\xi^3$
,, ,,	ammonia	$\alpha^2\nu$
,, ,,	chloride of ammonium .	$\alpha^3\nu\chi$
,, ,,	phosphide of hydrogen .	$\alpha^2\phi$
,, ,,	oxychloride of phosphorus	$\alpha^2\phi\chi^3\xi$
,, ,,	acetylene	$\alpha\kappa^2$
,, ,,	alcohol	$\alpha^3\kappa^2\xi$
,, ,,	hydrocyanic acid . .	$\alpha\nu\kappa$
,, ,,	cyanogen	$\alpha\nu^2\kappa^2$

We quote the following from the concluding remarks of the author:—

"Our conclusions on this point are so remarkable, and so contrary to anticipation, that doubtless we could never trust them but for the simple and exact process by which they are deduced. Now, the conceptions which we form of the nature of the elemental bodies constitute the fundamental theory of the science, for these conceptions comprise and determine every similar conception. The unit of the element hydrogen is here conceived of as a simple weight, and symbolised by the letter α, That, to say the least, this view may be permitted, is proved by constructing the symbols of chemical substances upon this hypothesis. There are, however, certain exceptions, be they real or apparent, in which this mode of expression is impossible." . . "The unit of the element mercury, and the units of several other metals, such as zinc, cadmium, and tin, so far as our imperfect experience extends, appear to be analogous in this respect to hydrogen. But these are the only elements of this simple composition. The units of a second group of which the element oxygen, symbolised as ξ^2, may be taken as a type, and to which belong sulphur θ^2 and selenium λ^2, are composed of two identical simple weights, and the facts of the science do not permit us to assume these units as otherwise composed. Lastly, another group of elements appears in this system of a different and more complex composition, to which group belong the elements chlorine $\alpha\chi^2$, bromine $\alpha\beta^2$, iodine $\alpha\omega^2$, nitrogen $\alpha\nu^2$, phosphorus $(\alpha\phi^2)^2$, arsenic $(\alpha\rho^2)^2$, and, in all probability, numerous other elements. The simplest view which, consistently with the fundamental hypothesis, can be taken of the composition of these elements, regard being had to the total system of chemical combinations, is that they are severally composed of a unit of hydrogen and of two identical simple weights—as, for example, in the case of chlorine, of the simple weight α and two of the simple weights symbolised by χ, so that the elements of this group are to be considered as combinations of elements of the two previous forms respectively."

The author concludes by saying that from these and other equations "we unavoidably have suggested to us as the ultimate origin of our actual system of combinations . . . a group of elements, $\xi, \theta, \chi, \beta, \omega, \nu, \phi$ . . . of the densities indicated by these symbols, and which, . . . we cannot but surmise, may some day become, or may in the past have been, 'isolated and independent existences.' Examples of these simple monad forms of material being are preserved to us in such elements as hydrogen and mercury, which appear in the chemical system, as records suggestive of a state of things different from that which actually prevails, but which has passed away, and which we are unable to restore."

"Such a hypothesis is not precluded to us, but nevertheless we are not to imagine that it is a necessary inference from the facts. So far as the principles or conclusions of this method are concerned, the "simple weights" $\xi, \theta, \chi, \beta, \omega, \nu, \phi$. . . . may be treated purely as "ideal" existences created and called into being to satisfy the demands of the intellect, to enable us to reason and to think in reference to chemical phenomena, but destined to vanish from the scene when their purpose has been served; and the existence of which, as external realities, we neither assume nor deny."

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

Remarks on some Recent Contributions to the History of the Benzole Series, by* A. H. CHURCH, *M.A., Professor of Chemistry, Royal Agricultural College, Cirencester.*

THE more elaborate and exact study of the homologues and derivatives of benzole has revealed many most important facts. Admirable digests of these recent researches will be found in Will's *Jahresbericht* for 1865 (pp. 514 *et seq.*), and in the second volume of Kekulé's *Lehrbuch der organischen Chemie* (pp. 528 *et seq.*). My present object in writing on this subject is twofold—I wish to reassert my own discovery of several new substances and new reactions, and I wish to vindicate the accuracy of some of my experiments against the attacks which they have suffered from one or two foreign chemists.

Twelve years ago my first paper on the benzole series was published. Since that time not only have there

* Communicated by the author.

been made many additions to our knowledge of hydrocarbons and of the nature of isomerism, but the process of fractional distillation has also been materially improved. Thus it has come to pass that some of my former results I now interpret differently, some I have modified or further developed, some I have corrected in later papers, while some are discoveries now generally acknowledged, and which, in not a few cases, have served as starting-points for the subsequent researches of other chemists. I am compelled, therefore, to attribute, in some measure at least, the hostile criticism of Mr. C. M. Warren and Professor Beilstein to their imperfect acquaintance with the whole series of my published notes and papers. I do not wish to enter into any personal controversy with my critics, and I will not speak of the manner in which my reputation as a chemist has been assailed, but I do feel bound to restate the broad facts concerning the matters in dispute, drawing my data entirely from published sources.

These matters in dispute may be arranged under the three heads of—1. Boiling points; 2. The parabenzole series; 3. Reactions.

I. Boiling Points.—The boiling points I assigned† in 1855 to benzole and to the cumole from cuminic acid do not differ widely from those given by Mr. Warren,‡ and even the slight difference that exists is probably due to the methods adopted for correcting the observed temperatures—

	Warren.	Church.
Benzole . . .	80·1	80·8
Cumole . . .	151·1	148·4

With toluole, xylole, and cymole the case is different. Warren places the boiling point of toluole at 110·3°, my determination gave 103·7°,§ a result not far from that of Glénard and Boudault (106°) and that of Max Dürre. Coal naphtha, there is no doubt, contains a large quantity of a hydrocarbon boiling between 109° and 113°, and seemingly having the composition and properties of the toluole from toluic acid; but this fact is not incompatible with the co-existence of other hydrocarbons of the same formula. I may have placed the boiling point of toluole 6° too low; all I can say as to this matter is that the liquid boiling at 104° gave me every proof of its being toluole.

Xylole was discovered by Cahours in the light oils of wood naphtha. It was ascertained by its discoverer to boil between 128° and 130°. My experiments led me to fix its boiling point a little lower, at 126·2°‖; and as I obtained from coal naphtha an oil having the same composition and properties, and yielding apparently the same derivatives, I concluded the two hydrocarbons to be identical. Mr. Warren fails to discover in his sample of coal naphtha this hydrocarbon boiling at 126°—he concludes at once that it does not exist in any coal naphtha, and that my experiments are untrustworthy. As, however, Mr. Warren makes out Cahours to have been wrong as to his xylole, and tells us that Mansfield mistook cumole for cymole, I cannot think myself very badly off in sharing with those eminent chemists the censure of Mr. Warren, for, "if gold rust, what should iron do?" The liquid which Mr. Warren calls xylole is the petrole of Bussenius and Eisenstuck;¶ the pseudocumole¶ of W. De la Rue and H. Müller; my paraxylole,** and has also been redescribed by Béchamp†† and by Naquet.‡‡ But that the true xylole discovered by Cahours really does exist I cannot doubt. I would here merely add that the boiling point of my xylidine,§§ 213°—214°, differs by little more than 1° from the number assigned by Deumelandt‖‖ to xylidine obtained from a coal naphtha fraction boiling 13° above that which yielded my product.

The case of cymole still remains. Warren does not find this hydrocarbon in coal naphtha, while he affirms the boiling point of the cymole from oil of cumin to be 179·6°. Dr. Noad, who prepared large quantities of this liquid, gives 171·5° as its boiling point, while my determination was 170·7° for the oil as distilled from sodium, and 175° to 176° after treatment with oil of vitriol. This number 175° is that now generally confirmed by other chemists as the true boiling point of cymole.

The discrepancies between some of my boiling points and those more recently determined depend in great measure upon the different corrections applied to the thermometric indications, and also upon the existence in coal naphthas of two series of isomers, which seem to me to have been jumbled together by some observers. On this second point a word or two will at once explain my meaning.

Warren accepts 80·1° as the boiling point of benzole; the identity of benzole from various sources is generally allowed. Now cumole obtained from cuminic acid boils, according to Warren, at 151·1°. I do not suppose that any one has good grounds for controverting the statement that benzole from benzoic acid, and boiling at 80·1°, and cumole from cuminic acid, and boiling at 151·2°, are members of the same series. Both are derived by the same process from homologous acids.¶¶ If we compare, as we may fairly do, their boiling points, to what difference for C_2H_2 does it point? Not to Mr. Warren's 30°, but to the smaller difference of 23° or 24°.

Difference for $3CH_2$.

Benzole . . . 80·1° } 71·1° = 23·7° × 3.
Cumole . . . 151·2° }

Nearly all the difficulties suggested by the divergent results of different experimenters will be explicable if the existence in various coal naphthas of two or more series of benzolic homologues be granted. Warren, while readily admitting the occurrence of several similar isomeric series in different kinds of natural and artificial paraffin oils, seems to deny the occurrence of analogous variations in different samples of coal naphtha.

II. The Parabenzole Series.—In treating of the boiling points of the benzole series, I have necessarily referred to the existence of an isomeric series of hydrocarbons. Warren makes the very obvious suggestion that parabenzole is a mere mixture of benzole and toluole. I originally entertained the same notion myself till a close examination of the physical and chemical properties of this liquid convinced me that it was untenable. I have sufficiently combated this idea in my notes on the parabenzole series published in the volume of the Chemical News before cited.

The existence of an isomeric benzole has received strong confirmation in some experiments by Fittig, the occasional collaborateur of Beilstein. He finds a hydrocarbon, in some points closely resembling parabenzole, in

† *Phil. Mag.* 1855.
‡ *Sil. Amer. Journ.* (2) xl. pp. 89, 216, 384.
§ *Phil. Mag.*, 1855.
‖ *Ann. Chem. Pharm.* cxiii. 151.
¶ *Phil. Trans.* 1863, pp. 331, 342.
** Chem. News, xii. 292.
†† *Compt. Rend.* 1864, lix. 47, 305.
‡‡ *Ibid.* lix. 199.
§§ *Phil. Mag.* 1855.
‖‖ *Zeitschrift für Chemie*, 1866, p. 21.
¶¶ The fusing points of the acids of the benzole series demand further investigation.

the products of the distillation of camphor with zinc chloride.

I will add one fact about the occurrence of parabenzole in coal naphtha which may serve to account for its non-detection by some observers. My experiments were made with fractions boiling at about 100°, and which had been collected during some years in numerous distillations of large quantities of the naphtha; yet a few ounces only of parabenzole was the ultimate product.

III. Reactions, and New Compounds and Processes.—The following are the chief points under this head to which I would wish to call attention. I claim as my own the following processes, methods, &c., most of which have been republished of late years as new discoveries or adopted without acknowledgment:—

1. The purification of hydrocarbons by distillation from sodium. (*Phil. Mag.* 1855.)

2. The production of the so-called "nitro-sulpho" acids by dissolving nitrobenzole, &c., in oil of vitriol or Nordhäusen acid. (*Ibid.* 1855.)

3. The oxidation, by chromic acid, of nitrotoluole and its homologues into β nitrobenzoic acid, &c. (*Ibid.* 1861.) In 1862 I showed in the International Exhibition a specimen of this β nitrobenzoic acid thus labelled and distinguished from the ordinary α acid.

4. The oxidation of sulpho-toluenylic acid into benzoic acid by the action of chromic acid.

5. The probability of the existence of methyl-benzole, &c. (*Phil. Mag.* 1859.)***

I trust that none of the foregoing remarks will lead any one to suppose that I underrate Mr. Warren's own researches. While demurring to much of his criticism, I look upon some parts of his experimental investigation as monuments of patient labour and as most valuable additions to our accurate knowledge of a complex subject. And, with reference to Professor Beilstein, I am far from denying that in some particulars his criticism, though rough, is just. For example, in my earlier papers I rested my convictions of the identity of some of the benzolic homologues from various sources upon experimental grounds, which have since been shown to be inadequate. Then, again, I stated in 1855 (*loc. cit.*) that coal-tar toluole, by digestion with sodium, yields two hydrocarbons differing in boiling point—an assertion which is erroneous if pure toluole be operated upon, but which I myself corrected in 1857, explaining, at the same time, the real facts of the case. In the other charges which Professor Beilstein brings against my statements, I believe him to be unjust, and that he is so in some instances may be proved very readily. He states††† that I assert xylole to be changed into benzoic acid by oxidation with chromic acid. The fact is that, on the contrary, I offered no experiments of my own on the subject, but simply stated‡‡‡—"I have *not* yet experimented with the *xylole* series!" The last matter in which my reputation is assailed is as to the identity of the α and β nitrobenzoic (nitrobenzoic and nitrodracylic) acids; as already stated, I affirmed them to be different as early as 1862. But Professor Beilstein is not content with charging me with the terrible mistake of confounding two bodies which every one knows are actually *isomeric*, for he does me the further kindness of recommending *my* process as the best method of preparing the β nitrobenzoic acid! He does this without acknowledgment in his attack on another chemist.§§§

*** *Vide* Fittig and Tollens, *Ann. Chem. Pharm.* cxxxi. 304.
††† *Zeitschrift für Chemie*, 1865, p. 670.
‡‡‡ *Phil. Mag.* March, 1861.
§§§ CHEM. NEWS, 1866, p. 61.

PHYSICAL SCIENCE.

*On the Occlusion of Hydrogen Gas by Meteoric Iron,** by THOMAS GRAHAM, *F.R.S.*

SOME light may possibly be thrown upon the history of such metals found in nature as are of a soft colloid description, particularly native iron, platinum, and gold, by an investigation of the gases which they hold occluded, such gases being borrowed from the atmosphere in which the metallic masses last found themselves in a state of ignition. The meteoric iron of Lenarto appeared to be well adapted for a trial. This well-known iron is free from any stony admixture, and is remarkably pure and malleable. It was found by Wehrle to be of specific gravity 7·79, and to consist of—

Iron	90·883
Nickel	8·450
Cobalt	0·665
Copper	0·002

From a larger mass a strip of the Lenarto iron 50 millimetres by 13 and 10 millimetres, was cut by a clean chisel. It weighed 45·2 grammes, and had the bulk of 5·78 cubic centimetres. The strip was well washed by hot solution of potassa, and then repeatedly by hot distilled water, and dried. Such treatment of iron, it had been previously found, conduces in no way to the evolution of hydrogen gas when the metal is subsequently heated. The Lenarto iron was enclosed in a new porcelain tube, and the latter being attached to a Sprengel aspirator, a good vacuum was obtained in the cold. The tube, being placed in a trough combustion furnace, was heated to redness by ignited charcoal. Gas came off rather freely, namely—

In 35 minutes . .	5·38	cub. centims.
In 100 minutes . .	9·52	,,
In 20 minutes . .	1·63	,,
In 2 hours 35 minutes	16·53	,,

The first portion of gas collected had a slight odour, but much less than that of the natural gases occluded from a fire by ordinary malleable iron. The gas burned like hydrogen. It did not contain a trace of carbonic acid, nor any hydrocarbon vapour absorbable by sulphuric acid. The second portion of gas collected, consisting of 9·52 cub. centims., gave by analysis—

Hydrogen . .	8·26	cub. centims.	85·68
Carbonic oxide .	0·43	,,	4·46
Nitrogen . .	0·95	,,	9·86
	9·64		100·00

The Lenarto iron appears, therefore, to yield 2·85 times its volume of gas, of which 86 per cent. nearly is hydrogen. The proportion of carbonic oxide is so low as 4½ per cent.

The gas occluded by iron, from a carbonaceous fire, is very different, the prevailing gas then being carbonic oxide. For comparison a quantity of clean horse-shoe nails was submitted to a similar distillation. The gas collected from 23·5 grammes of metal 3·01 cub. centims.) was—

In 150 minutes . .	5·40	cub. centims.
In 120 minutes . .	2·58	,,
In 4 hours 30 minutes .	7·98	,,

The metal has given 2·66 times its volume of gas. The first portion collected appeared to contain of hydro-

* Read before the Royal Society, May 16, 1867.

gen 35 per cent., of carbonic oxide 50·3, of carbonic acid 7·7, and of nitrogen 7 per cent. The latter portion collected gave more carbonic oxide (58 per cent.) with less hydrogen (21 per cent.), no carbonic acid, the remainder nitrogen. The predominance of carbonic oxide in its occluded gases appears to attest the telluric origin of iron.

Hydrogen has been recognised in the spectrum analysis of the light of the fixed stars, by Messrs. Huggins and Miller. The same gas constitutes, according to the wide researches of Father Secchi, the principal element of a numerous class of stars, of which α Lyræ is the type. The iron of Lenarto has no doubt come from such an atmosphere, in which hydrogen greatly prevailed. This meteorite may be looked upon as holding imprisoned within it, and bearing to us, hydrogen of the stars.

It has been found difficult, on trial, to impregnate malleable iron with more than an equal volume of hydrogen, under the pressure of our atmosphere. Now, the meteoric iron gave up about three times that amount, without being fully exhausted. The inference is that the meteorite has been extruded from a dense atmosphere of hydrogen gas, for which we must look beyond the light cometary matter floating about within the limits of the solar system.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, May 28, 1867.

At the meeting of the Society of Encouragement on May 17, M. Tresca, who replaces M. Combe in the secretary's chair, paid a high compliment to the new steam engines of M. Duvergier, the constructor of the boats now plying on the Saone and Loire; he pointed out improvements in the machinery and in the employment of steam.

M. Julien Caûdron, ropemaker at Malaunay (Seine Inférieure), submitted to the Society (Rope Section) ropes, splices, and knots of cotton, which, owing to their tested strength and cheapness, are preferred, for naval purposes, in some cases to hemp ropes. Experiments made at the several seaports amply confirm the hopes of the inventor.

M. Payen resumed, in a rather long but learned and interesting discourse, the progress accomplished in the fabrication of paper, parchment, and the employment of parchment paper for the separation, by endosmose, of the salts which hinder the extraction and crystallisation of sugar contained in juices, syrups, and molasses. After having called to mind the physical and chemical composition of herbaceous or woody fibres, he enumerated—1. The papers of MM. Bachet and Machard, who treat the sprigs of fir first by hydrochloric acid, and afterwards by chloride of lime to bleach them. 2. The papers made from seaweed and other marine plants obtained nearly in the same manner by MM. Poinsot, Breton, &c. 3. The lucern papers of M. Caminade, the wild-thistle papers, the straw and sparta papers, &c. 4. Chinese rice papers, or those made from the pith of the *Laruca paperia*; 5. The parchment papers of M. Neumann, at St. Denis. We shall not return to the subject of the osmose of sugars, as we think our readers are already sufficiently initiated into it.

M. Isambart had at work two magnesium lamps, the first being exactly similar to that of M. Solomon. A movement by clockwork rapidly unrolls the magnesium wire, which is coiled on a bobbin. It has the inconvenience of disengaging too much white vapours of magnesia, which for a moment obscure the light. The second is only a modified Larkin's lamp; and M. Isambart should not have omitted to mention his name. An ordinary spirit-lamp occupies the bottom; a glass tube forms a chimney; a small box or recipient containing magnesium in powder mixed with 50 or 80 per cent. of fine sand. By turning a small button a cock is opened; the mixture is inflamed, and burns with a very brilliant light. We prefer the first light to the second, of which the intermittent and unsteady light is intolerable to the eye. M. Isambart said that the expense per hour of the second lamp was about 3 fr., and that the price of magnesium may still be lowered. At 3 fr. this intense light is not too dear.

M. Durand presented, and set at work, a small model of a brick-making machine, representing one of the novelties of the Exhibition, of which we shall speak shortly.

M. Julien presented a pamphlet on iron and steel. We do not wish to enter into controversy here on this subject, only we notice that iron and carbon do not combine; they only mix together as water and oil.

M. Emile Petit sent specimens of artificial lithographic stones. We wish him success, as the lithographic presses of MM. Kocher and Houstiaux require for continuous impression cylindrical stones of a size difficult to be found in nature.

M. Lavollée, in the name of the Committee of Commerce, read a report on the exportation of the habitable constructions by M. Benis. Two portable private houses were sent out to the Island of St. Thomas. The walls were formed of two vertical and parallel sheets of scagliola or imitation of marble, the interior being filled up with wood shavings, alga marina, &c. The ceilings are partly of iron and partly of wood subjected to the process of injection of sulphate of copper and tar afterwards. The floors are of imitation marble, &c. The cost of the two houses was 45,000 fr., including 1100 fr. for the carriage. Their aspect is exactly that of houses built of marble.

M. Tresca made a communication on the mechanical applications in the interior of mines. Works in mines require a motive power, either sudden and discontinued or continuous and slow. In the first case, the best motor is compressed air; in the second, water under pressure. As in tunnel work there can be no admission of fire, combustion, or the engendering of steam. Compressed air has been happily employed by M. Sommelier for the engines used by him in the tunnel of the Alps. Water under pressure was employed by M. Perret in the works of the South of France railways, to give a rotatory movement to the rings or circles of M. Deschaux, armed with diamond points for cutting the hardest rocks. The great problem of the day is the mechanical getting of coal. He explained and put before the eyes of the members two models; one of Carrett, Marshall, and Co.'s coal-cutting machine, the other of that of Jones, Levick, and Co., of Newport, Mon.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Group V.—Class 44: *Chemical and Pharmaceutical Products.*

Felix Dehaynin, of Paris, has founded at Aubervilliers, near Paris, some large chemical works, for the treatment, on a large scale, of the products of the distillation of coal tar. One would scarcely believe that the quantity of coal tar annually distilled in the manufactory of Gosselies, where the dust and small coal are agglomerated in the form of small bricks, of immense utility for railway locomotives, amounts to eight or ten thousand tons. It is then treated by another operation, and transformed into benzol, nitrobenzol, and aniline, substances employed for the preparation of the new colours, the solution of caoutchouc, removal of grease from stuffs, leather varnishing, &c. The benzol, nitrobenzol, and the aniline of Aubervilliers are much esteemed. The eye cannot con-

template without astonishment the array of twenty-five bottles, which only form a part of the products of the distillation of coal.

The glass case of M. Robinet, of Paris, 3, Rue de l'Abbaye Saint-Germain, formerly President of the Academy of Medicine, is distinguished from his neighbours' by the fact that he sells nothing, that he gives away all the products he obtains—that is to say, his numerous analyses of waters—and he limits himself to the task of soliciting new ones, which he analyses in succession, and gives gratuitously the results of his analyses to those who send the samples. He even goes so far as to give bottles of certain waters to those who, for particular reasons, would be interested in knowing the nature of those in their neighbourhood; and he bears the expense of carriage, bottles, &c., even if they are sent to the other end of the world. What motive has induced M. Robinet to make so many great sacrifices, and to give himself so much labour? Nothing is more simple to answer. He has undertaken to fill up a void in the physical history of our country; he has given to science, industry, agriculture, and public salubrity, a Hydrographic Dictionary of France. There exist, undoubtedly, already, numerous documents from which such a work might be compiled; but they are scattered about and incomplete. The "Geographical Dictionary" no longer exists. The work of 221 pages, published under this title in 1787, by M. Mothey, geographer to the king, did not fulfil the required result. M. Robinet set courageously to this task after the work he had performed as reporter to the commission of inquiry for the diversion of the waters of the Dhuys. He proposes to treat of soft or potable waters in a statistical, geographical, geological, chemical, economical, hygienic, and agricultural point of view. A first essay, already published, devoted to the study of the basin of the Marne, amply proves that the author will complete his programme.

In his glass case we find a hundred specimens of water, and one of the labels bears the number 2082. In fact, M. Robinet has analysed more than 2000 waters! His exhibition is only intended to invite remittances of water from the four quarters of the globe. We would say that his appeal has already been responded to, for we find in the galleries waters from London, the Danube, &c., and there is every reason to hope that the geographical dictionary especially devoted to France will also interest, in a greater or less degree, most of the foreign nations. We sincerely wish that, among the numerous pilgrims to this great *fete* of nations, some will not object to encourage his work and send specimens of waters. The notation for the representation of watercourses of M. Robinet is well worthy the attention of hydrographic and other engineers, his new system gives immediately a very exact idea of the direction, extent, inclination, and other essential characters of watercourses. In order that the remittance of water to be examined may be complete, it should comprise the waters of the rivers, brooks, and wells, with the nature of the soil in which they rise, drainage water, rain water collected in an earthenware or porcelain vessel, and drinking water from the public fountains.

We find in the glass case of M. Joly, of La Rochelle and Paris, No. 13, Rue d'Antin, a very original and new product—viz., marine silk. M. Joly discovered in the eggs of fishes of the family of Sebacians (the ray) that their exterior envelope is formed of a very close tissue, composed of an infinite number of delicate filaments which are easily removed and separated. Once drawn out they possess the appearance, colour, and finish of cocoon silk, serving without trouble for tissues of ordinary silk or silk wad. The interior of the eggs contains an albuminous white substance which can serve usefully in competition with the white of hens' eggs for printing on tissues; they contain a considerable quantity, as each roe weighs on an average 240 grammes (about ½lb.) The manufacturing industry of tissues will certainly make good use of these new products.

We also remark in the collection of M. Joly:—1. His cream of cod-liver oil, much more agreeable to the taste, and more digestible, than the best and purest ordinary cod-liver oil. 2. His qualus-liver oil, which M. Joly was the first to think of extracting from these fishes. 3. Fish-liver oil for leather manufacture. 4. French guano, a manure formed of edible fish and the debris of fisheries, very much sought after by agriculturists, and which is likely to improve the condition of the fishermen, as they can sell with profit what was formerly thrown into the sea.

The pharmaceutical establishment of M. Ch. Genevoix, 48, Rue Bonaparte, was the first that, thirty years ago, manufactured in quantities of a ton a day, ferruginous pills and lozenges. His syrups of iodide of iron and his purgative lemonade are remarkable for their indefinite preservation. His gaseous powder replaces, weight for weight and with much economy, tartaric acid in the preparation of aerated waters in the gazogene apparatus with two compartments. The Paris hospitals employ every year, on an average, 10,000 packets. The quality, the attractive form, the low price, and excellence of manufacture combine to render the establishment of M. Ch. Genevoix a model pharmacy.

M. Emile Genevoix, 14, Rue des Beaux Arts, exhibits feculous seeds and fruits containing from 1 to 10 per cent. of different oils which play an important part in alimentation. Disseminated between the grains of starch, these oils can be extracted by means of sulphuret of carbon, chloroform, benzol, ether, &c. M. Genevoix substituted for these solvents, firstly, carbonisation by sulphuric acid, which, in spite of the high temperature produced, set the fatty matters at liberty, without destroying them, in a state easily soluble in menstrua, or able to be obtained in a greater quantity by distillation. But this method was too costly when it was used on the large scale, and it has given place in the factory of M. Genevoix to an industrial process which allows the production by tons weight of the oil of some fruits, very abundant and without value—the horse-chestnut, for example. Bought at 40 or 50 fr. the ton, the finest chestnuts are rasped, submitted to a full fermentation, boiled in ten times their weight of water, and transformed into glucose by the addition of 2 per cent. of sulphuric acid. The liquor, freed from insoluble portions, is submitted to a slow ebullition, which allows the oil to agglomerate at the surface particle by particle. Drawn off and filtered, this oil is sold to the public without any addition. For ten years past the average quantity of oil manufactured in the chemical works at Romainville has been 600 kilogrammes, extracted from fifty or sixty tons of horse-chestnuts, which were bought from agriculturists for 2500 to 3000 fr. The wholesale price of the oil is 20 fr. Vegetable wax is separated from it under the form of stearin, margarin, &c. The water on which the oil floats, when neutralised, gives "syrup of glucose," and "horse-chestnut alcohol," prepared for trade on a large scale. The fabrication of starch had to be abandoned, as the supply of horse-chestnuts was uncertain and insufficient.

This fatty substance, very fluid, absorbable by the skin, has a place marked out in the therapeutics of the gout and rheumatism—in fact, the chestnut oil of M. Genevoix has been found very efficacious, and enjoys a great success.

M. Genevoix, struck with the happy effects obtained by the valerianate of ammonia, has combined valerianic acid with other new base. His valerianate of triamyline contains four equivalents of valerianic acid. If the medicinal action depends upon the acid, and not upon the base, the new compound cannot fail to be successful.

Poultices are attended with great inconvenience in consequence of their weight, their cooling, and their more or less disagreeable odour. For the application on the skin of liquid medicaments, laudanum, tincture of iodine, or fatty matters, M. Genevoix proposes an impermeable

tissue enclosing a double layer of swanskin, which is wetted with a decoction of marshmallows, linseed, or poppyheads, and which preserves its temperature for more than twelve hours at 70° C.

PROCEEDINGS OF SOCIETIES.

ROYAL INSTITUTION.

Tuesday, May 21, 1867.

A Course of Four Lectures on Spectrum Analysis with its Applications to Astronomy, by* William Allen Miller, *M.D., LL.D., Treasurer and V.P.R.S., Professor of Chemistry, King's College, London.*

Lecture II.

Spectra of Simple Bodies.—Spectra of Compounds.—Effect of Temperature upon each of these Classes of Spectra.—Mode of Comparing Spectra with each other.—Analysis of Artificial Flames by the Spectrum.—Nature of Information thus obtained.—Discovery of New Metals by the Spectrum.

In the last lecture I brought before you three different classes of spectra—1. The spectra produced by the ignition of solid and liquid bodies, which are continuous. 2. The spectra of ignited gases, which are discontinuous or interrupted. 3. Composite spectra, the result of the action of the spectrum of an ignited gas or vapour upon a continuous spectrum at a higher temperature which is transmitted through the gaseous spectrum. We have, therefore, 1, spectra exhibiting one continuous shaded band of varying colour, from red, on the one hand, to violet on the other; 2, spectra in which certain colours only are present, each band of colour being perfectly definite and referable to the particular substance by which it is produced; and 3, we have absorption spectra produced by the superposition of this second class of spectra upon the first.

I purpose to-day to confine our attention chiefly to those spectra which are furnished by the incandescence of gaseous matter under different conditions—different specially as regards temperature; for the study of differences of this kind is particularly necessary to enable us correctly to interpret the changes going on in objects at a distance.

It is a remarkable, but, at the same time, not, perhaps, on consideration, a very surprising fact, that the same substance in the liquid or solid condition should give out a very different spectrum from that which it exhibits in the gaseous state. The particles of which bodies consist in the solid or liquid form are fettered, so to speak, by association with each other. Consequently, the vibrations to which they give rise are, of necessity, of a more composite order than those which would be produced by the same substance if it were converted into the gaseous condition, where its particles not only have no mutual attraction, but are powerfully self-repulsive. These ultimate particles or atoms, in the case of simple bodies—molecules in the case of compound bodies—by the fact of their being raised in temperature, acquire motions of their own, which they are able to communicate to the ether; and by these motions they occasion in us the sensation of light

I shall, for the purpose of fixing our ideas, project upon the screen before you, in the first place, two or three gaseous spectra of elementary metallic bodies which appear to exist in the atmosphere of the sun. These metals will be, successively, iron, nickel, and chromium. The proportion of iron in the atmosphere of the sun, as we shall see on a future occasion, is very considerable. It is also probable, but not absolutely certain, that nickel is there; and there appears to be no doubt that chromium is present. Iron, at first, will give a comparatively feeble spectrum. As the temperature rises, the particles of the iron will become more intensely incandescent, and the spectrum of the metal will proportionately increase in brilliancy. Iron is a metal which requires an extremely high temperature for its volatilisation; and therefore, until the charcoal points have become fully ignited, the bands are apt to appear more fitfully than is the case with more volatile metals, such as zinc and thallium, and some others, which we have had occasion to examine already. The bright bands which are here prominent will be some of those to which I shall have to call your attention hereafter when we consider them in relation to the sun's spectrum. As the iron has now disappeared, we will introduce another magnetic metal—nickel. The spectrum of nickel is one in which we have certain bands in the green particularly prominent, and, like iron, nickel is a metal which requires a very high temperature for its volatilisation. Each of these metals is an elementary substance, so far as we at present know, and, as you see, is capable, in the intense heat of the voltaic arc, of becoming converted into vapour. We will next examine the spectrum of chromium. The chromium bands are also very characteristic; among them you will observe a number of brilliant lines in the blue. These three metals cannot be volatilised in the heat of such a flame as the Bunsen gas flame, which is produced by burning a mixture of atmospheric air with coal gas, although it is a very hot flame, and may be used to volatilise a large number of substances. Amongst others it volatilises the metals of the earths and of the alkalies and most of their compounds; but it does not volatilise the metals which belong to the class with which we are at present engaged. The spectra produced by the ignition of the elementary bodies are different from those furnished by the compounds of the same bodies. Many of these compound substances, if heated to a temperature not sufficient to decompose them, exhibit peculiar spectra. The number of compound bodies, however, which can be so converted into vapour in a common flame without undergoing decomposition, is comparatively small. Metallic sodium has its own peculiar spectrum, which I have already shown you; there is also a spectrum of potassium equally characteristic, and these appear when the compounds of sodium and potassium are decomposed by heat without special precautions. But if you volatilise the chlorides of these substances in an atmosphere of chlorine, the characteristic spectra of these metals will disappear altogether. This is an experiment that I do not venture to make here on account of the extremely irritating nature of the fumes. Indeed, I am not able to project upon the screen directly the spectra of compound bodies, and for a reason which will be at once understood. The temperature which is required for a sufficient ignition to enable us to project any spectrum upon the screen is exceedingly high, far beyond any that we can attain in our furnaces, so that the very act of producing a sufficient heat to render them luminous enough to be seen by a large audience would be attended with the actual separation of their constituents, and the destruction of the compounds themselves as compounds.

I shall, therefore, in order to give you some idea of the difference between the spectra of the elements and their compounds, ask you to look at a photograph representing the spectra of certain compound substances. I have selected the spectra produced by the compounds of copper, because they resist a higher temperature than most others without undergoing decomposition, and are consequently amongst those most easily observed. On this photograph you will see a representation of three spectra, placed one over the other. The uppermost is the spectrum of metallic copper; the second is the spectrum of cupric chloride, or the compound of copper with chlorine; and the third is that of cupric iodide, or the compound of copper with iodine. You will observe certain lines in the yellow and the green, which are pretty constant in them all. In the second spectrum, characterised by lines in the blue, we see the effect produced by the combination of chlorine with the copper; and this is again different from the spectrum of the iodide. When

* Reported specially for this paper, and revised by the author.

Bunsen and Kirchhoff first made their experiments upon the volatilisation of bodies in the flames upon which they experimented, they concluded that, whatever the temperature employed, the same spectrum was always produced by the same substance. That statement has since, however, been ascertained not to be absolutely correct. An elementary body may be heated through a very wide range of temperature without experiencing any change in its spectrum, but at a very high temperature new lines not previously observed often make their appearance. I am indebted to my friend, Mr. Crookes, the discoverer of thallium, for the loan of this diagram representing the spectrum of the metal at an intense heat, and also for some specimens of thallium itself. Here is a bar of thallium, the body of which I am now speaking, of between two and three pounds in weight. It is one of the rare metallic elementary bodies recently discovered by the application of this method of spectrum analysis. The ordinary spectrum of thallium exhibits a single strong band in the green; but when the electric spark is sent between two thallium wires, supported on a suitable insulating stand, if the light of this spark be examined by the spectroscope—an instrument the plan of which I shall presently have to explain—not only does the brilliant green band come out, but a series of others are produced, especially in the more refrangible part of the spectrum, in consequence of the intense heat of the electric spark. Several other bodies show the same phenomenon, and exhibit additional lines in the more refrangible portion of the spectrum when the temperature is sufficiently raised.

Lithium offers an example of this kind. This metal presents a single characteristic line—viz., a brilliant crimson band—which is brought out at moderate temperatures; but there is another, a fainter line, in the orange, which requires a higher temperature for its development; and, lastly, a very brilliant band in the blue, which requires a still higher heat, such as that of the voltaic arc. I believe the first time this blue band was seen was in the theatre of this Institution at a lecture by Dr. Tyndall. I have here in one of these diagrams a representation of the spectrum of lithium indicating the blue line, which we shall presently see, in addition to the two lines in the red and the orange usually seen in the lithium spectrum. The orange line is, indeed, a little too bright in comparison with the other when seen by the gas flame. [The green line of thallium was produced.] That is the beautiful green line of thallium when heated in the voltaic arc; and if I could produce a sufficiently intense heat, by sending an electric spark between wires of this metal, to project the light on the screen, a large number of other lines, which are not now visible, would be developed in the still higher temperature thus obtained. Although in the voltaic arc we have a most intense heat, the temperature is not sufficient to cause the thallium to vibrate in such a way as to produce more than a single line. The lithium at the same temperature will acquire the power of producing an additional number of vibrations of increased frequency, so that we shall have at least three distinct bands—a band in the red, a band in the orange, and another in the blue. [Lithium spectrum shown.]

Hitherto I have taken the substances in their metallic state, but I wish to show you, in the next place, that if we take certain bodies in their compound condition we may separate their constituents from each other in the flame of the voltaic arc. For instance, if, instead of taking metallic barium, I take a compound of barium with chlorine, and heat that strongly in the lamp, the chlorine and the barium at that very elevated temperature will be separated from each other; the barium will be converted into vapour, and we shall obtain from the metal its characteristic series of bands, the chlorine spectrum being so faint as to elude our observation under these circumstances. [Barium spectrum from chloride of barium shown.] I must request you to bear in mind the position of these bands, as I am about to take another compound of barium in order to demonstrate the fact that we are here really dealing with barium itself. We before had the chloride. Now I take the carbonate of the same substance, and this carbonate will at the same temperature be resolved into barium on the one hand, which is the glowing gas from which that spectrum was produced, and into other bodies which give out comparatively little light, and which, therefore, occasion no interference with the results. [Spectrum of carbonate of barium shown.] You see the spectrum is not quite so bright as the last, for the reason that the carbonate is not a body which is so completely and easily volatilisable as the chloride. The chloride is a substance which, like most chlorides, is readily volatilised by a moderate heat. The carbonate is a body which, at a high temperature, becomes decomposed. It gives off its carbonic acid and produces baryta, and that baryta, in the focus of heat which we have here, is undergoing decomposition. Its oxygen is being separated from it just as, when oxide of mercury is moderately heated in a spirit flame, we can separate that into its components—mercury on the one hand, and oxygen on the other. So it is here with baryta: in the intense heat of the voltaic arc, the barium and the oxygen are becoming separated from each other.

I want you, then, to draw a distinction—for it is a very important one—between the spectra of compounds and the spectra of simple bodies. It has been observed that the spectrum of a compound body generally exhibits a series of broad bands, whilst in the case of elementary bodies the characteristic spectra consist of sharp, narrow, bright lines.

I stated just now that when compound bodies were decomposed in the voltaic arc, their gaseous constituents, as they disappeared, produced little or no effect upon the spectrum; but you are not from that to conclude that a gaseous body—I mean a permanently gaseous body, such as oxygen or nitrogen—is not capable of producing a spectrum. It does give a spectrum, but one of very much less brilliancy and intensity of light than metallic bodies such as I have been showing you. I wish to make this manifest, but I cannot throw the spectra of these gases on the screen. They are so very faint that, if I were to attempt to produce them, they would be invisible at a distance. But I must show you an ingenious way in which this difficulty has been overcome by Plücker, who has succeeded in obtaining such spectra in a form in which he could analyse their light by the prism; and thus he has not only been able to distinguish one gaseous body from another, but even to measure the distances between the different lines of each and make maps of the spectra of these various bodies. Here I have four glass tubes, each containing a different elementary gas. These tubes have been made in a particular manner, in order that we may be able sufficiently to concentrate the heat of the electric spark in its passage through them to render the gas luminous. Each of these tubes consists of two somewhat wide portions separated by a narrow thermometer-like tube in the middle. At each end is a platinum wire melted into the glass, and there is a narrow tube at the side for the purpose of introducing gas, and then removing more or less of it, as may be necessary, by connecting this tube with an air pump. After the glass tube has been exhausted sufficiently it is melted off, and the vessel remains permanently charged with a quantity of gas for examination. When the experiment is to be made, the platinum wires are connected with the terminals of the secondary wire of a Ruhmkorff's coil, from which the induction spark is transmitted through the tube. You will see how different the appearance of the spark is when it passes through the wide part of the tube from that which it exhibits in passing through the narrow portion. In the latter it is much more brilliant, and the temperature is higher. It was by an arrangement of this kind that Plücker was enabled to increase the brilliancy of these spectra sufficiently to analyse their light by means of a prism. Here are hydrogen, nitrogen, chlorine, and iodine. You will observe

that I am showing you the entire light caused by passing the spark through these gases. Every one of these has a special light of its own. Here is the red light of hydrogen, the violet light of nitrogen; the third tube shows the peculiar light of chlorine, while the light of iodine in the fourth is quite different from any of the others. Each of these luminous lines, when viewed through a prism, is seen to consist of bright lines, as in the case of the metals. I cannot show you their spectra; if I could, I should be very glad to do so, because they are exceedingly beautiful.

Here let me say that, beautiful and brilliant as are the spectra which I throw upon the screen, they are totally unfitted in this form for examination from a philosophical point of view. The object of these experiments at the present time is to show distinctly and in a broad way the differences which exist in the spectra of different elements; but the philosopher, in examining these in his closet, has not merely to see that they are different, but he has to measure with great precision the intervals between each of these bars of light; for you will see that here, as in the notes of music, each one of these lines has its own special position in the scale, and we must know exactly what that position is in order to be able to recognise it again, so as to connect it with the substance by which it is occasioned. The eye has no means of comparing these differences as the ear compares sounds, but we are obliged by angular measures to determine the position of these lines with regard to certain fixed points. More of that, however, by-and-by.

(To be continued.)

CORRESPONDENCE.

Transparency of Red-hot Metals.

To the Editor of the Chemical News.

Sir,—Every reader of your valuable journal would note with interest, in your last week's impression, a letter upon the above subject signed "A. Adriani," but very few, I think, would endorse the author's opinions. With regard to Father Secchi's discovery of a crack in the interior of an iron tube by (seeming) transparency, is it not more likely that the crack exhibited itself because where it existed the metal would be thinner than throughout the rest of the tube, and would therefore cool more rapidly, becoming in consequence darker coloured, thus showing on the exterior both its extent and direction?

I am, &c.

W. F. K. Stock, F.C.S.

Laboratory, Darlington.

South Kensington Science.

To the Editor of the Chemical News.

Sir,—Can you or any one else tell me the meaning of *Science* in the South Kensington vocabulary, and why it should always be coupled with the word *Art* when it is spoken of west of Hyde Park Corner? What possible connexion is there between the two? and what occult reason is there that the public should have the idea incessantly dinned into them that the same faculties which have given us steam, the telegraph, the soda trade, and aniline dyes, are so intimately connected with Majolica Ware and Old Masters that they must perpetually form a binary compound of "Science and Art," as inseparable as "Box and Cox," "Pyramus and Thisbe," or "Medes and Persians?"

I rather suspect the true interpretation is this. The practical English public don't much care for Art, but they *do* care for Science; so the latter is tacked to the former to make it go down. If this is not the reason, and if *Science* is really valued at South Kensington, the officials there have shown a most unappreciative spirit in keeping it so much in the background as they did at the late inauguration of the Albert Hall of Science and Art.

I was one of the spectators there. I noticed numerous *Art* celebrities and official personages in seats of honour, but poor *Science* had to content itself in the crowd.

I am, &c. F.R.S.

[Our correspondent evidently had not a good "standpoint" in the crowd, or he would have seen two or three scientific men in reserved seats. We cannot say we feel the same indignation which our correspondent expresses at the non-recognition of science. English science requires no petting to enable it to flourish, and can exist in a healthy state without official patronage.—Ed. *C. N.*]

A Good Suggestion.

To the Editor of the Chemical News.

Sir,—Would you allow me, through the medium of your valuable journal, to make a suggestion? I would suggest that chemical students should learn some system of shorthand. This art is easily acquired. If the student would devote, say, an hour daily, or two hours a day three times a week, to learning and practising, he might attain such a degree of proficiency as would enable him in the course of three or six months to write at the rate of 80 to 90 words per minute. This rate would be sufficient for the purpose of taking notes at lectures, or, indeed, reporting most lectures verbatim. Shorthand writing will be found useful on many occasions—for instance, jotting down thoughts arising on the spur of the moment, and for making memoranda intended to be read by yourself only. Many other uses would suggest themselves for the employment of this art. Of course, to follow a very quick speaker and report his speech word for word, much time must be devoted to hard practice. I was able, after six months' practice, to write at the rate of 100 words per minute; many, however, find it impossible to go beyond 80 words.

The system I recommend is Pitman's "Phonography," which is written according to sound. Nothing, I am convinced, strengthens the memory so much as the use of shorthand. I have often attended lectures and taken down the greater part of them and the discussions arising, and have found, on coming to transcribe my notes into longhand, that I could do so with but seldom looking at the shorthand notes.

I trust many of your readers may be incited to learn the art of shorthand. The books required are cheap, the time taken to learn shorthand, especially Pitman's, is short, and it can be done without a teacher. I think that by drawing attention to this subject much good may be done.

I am, &c. J. H. Swindells.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Cantharidin.—Professor Dragendorff has found in cantharides a volatile body which acts on the organism in a similar manner to cantharidin. Freshly powdered cantharides are moistened with water and distilled; the portion going over below and at 100° C., which has an acid reaction, contains the new body.—(*Pharm. Zeitschr. f. Russl.*, Jan. 1867, i.)

Borates.—F. P. le Roux. Equal equivalents of calcined magnesia and boric anhydride, heated to whiteness, melt readily together, forming a slightly green, strong, and light glass. Rapid cooling is necessary to obtain it amorphous and transparent. Three equivalents of boric anhydride and one equivalent of suboxide of copper, melted together and poured on an iron plate, form a glass, the surface of which has a different colour from the interior.

Other borates behave in a similar manner; most of them form glasses of different colours, according to whether, after melting, they are cooled slowly or rapidly.—(*Comptes R.* lxiv. 26.)

Electrolysis of Alkalic Sulphides.—H. Buff. In an electrolyte under the action of an electric current, elements, or groups of elements, travel in opposite directions, carrying an equal amount of electricity of opposite nature; they are electric-equivalent. Constituents not taking part in this locomotion do not contribute to the conduction of the electric current.

From his experiments with alkalic sulphides, the author concludes that the decomposition of the various mono- or poly-sulphides of potassium or sodium always takes place in this manner, that the metals travel towards the one electrode and all the sulphur towards the other, or that a group of, for instance, five atoms of potassic pentasulphide is electric-equivalent to one atom of potassic monosulphide. —(*Ann. Chem. Pharm.* Supplem. iv. 257.)

Niobium and Tantalum, Chloro- and Chloro-oxygen Compounds of.—H. Sainte-Claire Deville and L. Troost (O = 16). The vapour densities of the volatile niobic chlorides and oxychlorides agree with Marignac's formulæ $NbCl_5$ and $NbOCl_3$. The presence of oxygen in the oxychloride may also be proved synthetically. If $NbCl_5$ (melting at 194° C., boiling at 240° C.) in a state of vapour is repeatedly driven over red-hot niobic anhydride (in a current of carbonic anhydride), it is converted into a white non-fusible body, volatile at about 400° C., having all the properties of the oxychloride.

$TaCl_5$ and tantalic anhydride, under the same conditions, do not act upon each other. The chloride obtained from pure tantalic anhydride, prepared according to Marignac's method, is crystallisable, melts at 211·3° C., and boils at 241·6°. It has a slight yellow colour, and decomposes slowly when exposed to air. The density of its vapour was found to be 12·8; theory requires 12·5 (Ta = 182).—(*Comptes R.* lxiv. 294.)

Rosaniline, Derivatives of.—H. Schiff (C = 12). Sulphite of rosaniline, dissolved in aqueous sulphurous acid (a yellow solution, containing leucaniline salt and polysulphite of rosaniline), shaken with a few drops of an aldehyde, evolves sulphurous acid, and a violet crystalline precipitate is gradually formed. Rosaniline salts treated in this manner with oil of bitter almonds, œnanthol, or valeric aldehyde, gives rise to the formation of the new bases

$N_3\left\{\begin{matrix}C_{20}H_{16}\\ C\ H_6\\ H\end{matrix}\right.$	$N_3\left\{\begin{matrix}C_{20}H_{16}\\ C_7H_{14}\\ H\end{matrix}\right.$	$N_3\left\{\begin{matrix}C_{20}H_{16}\\ C_5H_{10}\\ H\end{matrix}\right.$
Benzyliden-rosaniline.	Œnantyhliden-rosaniline.	Valeryliden-rosaniline.

The salts of these bases contain one equivalent of acid. The typical hydrogen may be replaced by ethyl. They are insoluble in ether, water, or dilute acids; soluble in alcohol, with a violet blue colour.

The author believes that the blue and violet dyes obtained by the action of the bromides of terebene and ethylene upon rosaniline have a similar constitution to the bases described.—(*Comptes R.*, lxiv. 182.)

Triamidophenol and Amidodiimidophenol.—C. Heintzel (C = 12). The product of the reduction of picric acid with tin and chlorhydric acid the author finds to be hydrochlorate of triamidophenol, protochloride of tin $C_6H_2(HO)(NH_2)_3(HCl)_3(SnCl_2)$, and not, as stated by Beilstein, $C_6H_3(NH_2)_3(HCl)_3(SnCl_2)$, hydrochlorate of picrammonium, protochloride of tin. The body is soluble in water, alcohol, and ether, and is obtained in white crystals by precipitating its saturated aqueous solution with chlorhydric acid. Sulphuretted hydrogen decomposes it, and forms hydrochlorate of triamidophenol, $C_6H_2(HO)(NH_2)_3(HCl)_3$, easily soluble in water, and obtained from its solution in white crystals on adding chlorhydric acid. It is less soluble in alcohol and ether.

Hydriodic acid reduces picric acid to hydriodate of triamidophenol $C_6H_2(HO)(NH_2)_3(HI)_3$, and not, as Lautemann stated, to hydriodate of triamidobenzol, or, as he called it, picrammonic iodide, $C_6H_3(NH_2)_3(HI)_3$.

Triamidophenol cannot be separated from its salts without decomposition.

Ferric chloride acting on the hydrochlorate produces the hydrochlorate of amidodiimidophenol,

$$C_6H_2(HO)(NH_2)(N_2H_2).HCl.$$

It dissolves easily in water, with a beautiful blue colour, is sparingly soluble in alcohol, insoluble in ether, and crystallises in dark yellow needles. The base cannot be separated from its salts without decomposition. Digestion with dilute chlorhydric or sulphuric acid converts this body into the hydrochlorate of a new base, the probable formula of which is $C_6H_2(HO)(NH_2)(NH)(HO).HCl$. That is hydrochlorate of amidoimidohydroxylphenol, soluble in water and alcohol.

Another new base is obtained from hydrochlorate of amidodiimidophenol on reduction with tin or zinc and chlorhydric acid of its aqueous, or, with sodium amalgam, of its acid solution. It can be isolated from its salts by means of an alkali. It crystallises in white needles, dissolves readily in water, sparingly in alcohol.

The author here corrects his former statement, published in a preliminary communication (*Zeitschr. Chem.* 1866, 211), that by this reduction the hydrochlorate of triamidophenol was regenerated.—(*Journ. prakt. Chem.* c. 193.)

Methods of Reduction, new Application of.—Berthelot (C = 12). Bromide of ethylene with water and potassic iodide, heated in sealed tubes for ten hours, is first converted into iodide of ethylene, and this is decomposed again according to the following equation:—

$$7C_2H_4I_2 + 4H_2O = 6C_2H_6 + 2CO_2 + 7I_2.$$

The reaction can only be explained by the supposition of a temporary formation of hydriodic acid. This caused the author to investigate the action of a strong aqueous solution of this acid on various substances at a high temperature (275° C.) in sealed tubes. Under these conditions hydrocarbons of the marsh-gas series were obtained in most cases.

Marsh gas was produced in this way from methylic formate, besides carbonic oxide and water, resulting from the decomposition of the formic acid.

Ethylic hydride resulted from the reduction of chloride, bromide, and iodide of ethylene, bihydriodate of acetylene, ethylic iodide, carbonic sesquichloride, ethylene, acetylene, alcohol, aldehyde, acetic and tartronic acid. The last-named body also gave rise to the formation of carbonic anhydride, evidently in consequence of its having split up originally into carbonic anhydride and acetic acid, the latter only giving ethylic hydride.

Propylic hydride was obtained from allylic iodide, glycerin, and acetone.

Butylic hydride from butyric acid and succinic acid. The gaseous hydrocarbons in most cases contained an admixture of hydrogen, derived, no doubt, from spontaneous decomposition of the hydriodic acid used in the experiments. From oxalic acid no carburetted hydrogen could be obtained, only carbonic oxide and carbonic acid, from formic acid carbonic oxide only (*Bull. Soc. Chem.* 7, 53).

MISCELLANEOUS.

Chemical Society.—The next meeting of the Society will be held on Thursday evening, at 8 o'clock, when a lecture "*On the Mode of Representation afforded by the Chemical Calculus, as contrasted with the Atomic Theory*," will be delivered by Sir B. C. Brodie, Bart. A large attendance of Fellows and visitors being anticipated on this occasion, the Royal Society have kindly placed their large meeting room at the disposal of the Chemical Society for that evening.

Dr. Odling's Lecture on the Absorption of Gases by Metals.—Our verbatim report of the above lecture was not returned corrected by the author in time for insertion in this number, but will certainly appear in our next.

The Paris Exhibition.—One of our earliest contributors, who is at the same time an eminent scientific chemist and a valued member of our editorial staff, is on the point of starting for Paris. His attention will be more especially directed to the English department of the Chemical Exhibition, and the results of his observations will be placed before our readers in a series of articles. These will be in addition to the usual articles forwarded weekly by our Exhibition correspondent.

British Association of Gas Managers.—The fourth annual general meeting of the members of this Association is announced to be held at Nottingham on the 11th, 12th, and 13th of June, when the following papers will be submitted:—"*The Utilisation of the Residual Products of the Manufacture of Coal Gas, with especial reference to the Production of Aniline Colours from Coal Tar*," by Dr. Letheby, M.B., M.A., &c., Professor of Chemistry in the College of the London Hospital, Gas Analyst and Medical Officer of Health for the City of London. "*On the Practical Working of the Liquor System of Purification;*" being a statement of results in continuation of the paper of last year on "An Improved Method of Purifying Coal Gas," by Mr. George T. Livesey, South Metropolitan Gasworks, London. "*On the Purification of Gas from Ammonia, and the Utilisation of the Product*," by Mr. George Anderson, London. "*Notes on the Manufacture of Sulphate of Ammonia*," by Mr. W. Esson, Gasworks, Cheltenham. "*On the Application of Liquid Hydrocarbons as a Substitute for Cannel in the Manufacture of Gas of High Illuminating Power*," by Mr. E. Goddard, Gasworks, Ipswich. "*Some Remarks on the Explosive Properties of Fire-damp and Coal Gas, with Particulars of Experiments made in Lighting Portions of the Oaks Colliery with Pit Gas*," by Mr. J. Hutchinson, Gasworks, Barnsley. "*On Leakage from Gas Mains*," by Mr. E. S Cathels, Gasworks, Crystal Palace District. "*On the Valves of Gas Purifiers*," by Mr. W. J. Warner, Gas-Works, South Shields.

Meetings for the Week.

Monday, June 3.

Royal Institution, 2 p.m., General Monthly Meeting.

Tuesday, June 4.

Royal Institution, 3 p.m. Professor Miller "*On Spectrum Analysis.*"

Geologists' Association, 8 p.m.

Wednesday, June 5.

Geological Society, 8 p.m.

Thursday, June 6.

Royal Institution, 3 p.m. Professor Huxley "*On Ethnology.*"

Chemical Society, 8 p.m.

Friday, June 7.

Royal Institution, 8 p.m. Mr. Ruskin "*On the Present State of Modern Art, &c.*"

Saturday, June 8.

Royal Institution, 3 p.m. Professor Huxley "*On Ethnology.*"

NOTES AND QUERIES.

Manufacture of Sulphuric Acid.—Sir,—I see by the CHEMICAL NEWS of April 26 (just received) that you propose to aid manufacturers by placing them in communication with competent parties to get them out of their difficulties. Now, I am in connexion with a company who have been for some time past manufacturing sulphuric acid from sulphur, but now wish to use pyrites, and desire to know the best process for that purpose. Our chamber is of the ordinary construction, and of the capacity 29,000 cubic feet We have already built four pyrites kilns; the internal capacity of each is about 1·51 m., and the distance these are placed from the chambers is 21 m., connected by an acid-proof earthenware tube of 0·50 m. diameter. Is this distance and tube sufficient to arrest any foreign matter the mineral may contain from getting into the chamber, and do you consider the kilns of good shape for burning Huelva or St. Domingo's ore freely? My object is to be placed in communication direct with a practical person who would give me all the information for working a chamber with pyrites on the best known plan, by correspondence and plans, if possible; and, if not, I would go or send a person to England for that purpose. Of course a fair remuneration would be given for the information. We concentrate our acid to 65° Baumé in a platinum still. Would pyrites acid distil perfectly colourless, and as pure as that made from sulphur?—T. G. H., Lisbon.

Chinese Blue.—Sir,—In answer to the inquiry for the way to make Chinese blue, I beg to say that I am quite able to show it for a consideration. I have been a colour maker twenty [years.—SAMUEL JOHNSON.

Estimation of Tartrates.—Sir,—In the CHEMICAL NEWS, No. 390, May 24, 1867, it is stated that a manufacturer of tartaric acid has expressed his willingness to give 100*l.* to any one who should succeed in discovering a correct and ready method for the estimation of tartaric acid in tartrates. Would you kindly give me the name of the manufacturer?—CHEMICUS.

[The statement is made on the authority of the authors of the book reviewed. Perhaps Mr. Watts will kindly give the required reference.—ED. CHEMICAL NEWS.]

Palm Oil.—Reply to "Milo," May 24:—The quantity of chrome necessary to bleach 1 cwt. of palm oil varies with the kind of oil, of which there are several in the market. It may vary from 0·85 to 1·25 lb. Care should be taken to purify the oil from all foreign matter; else more chrome will be required.—"BLEACH."

Chinese Blue.—Sir,—A substance called "Chinese Blue" has been referred to several times recently amongst your "Notes and Queries." I should feel much obliged to any of your correspondents who would tell me what is the composition of this substance.—"LEARNER," St. Helen's, Lancashire.

Naphthaline.—Sir,—Is there any process (heat excepted) by which naphthaline can be kept liquid?—W. B.

Letters are waiting at our Office for "Alpha;" H. P. Meaden; R. H. W.; Manufacturer.

ANSWERS TO CORRESPONDENTS.

Articles by D. Forbes, F.R.S., T. Sherlock, and Dr. Phipson are in type, but are unavoidably postponed. Our report of last Monday's meeting of the Academy of Sciences arrived too late for insertion in this number.

F. S. J.—Evidently chalk and paraffin oil.

Studiosus.—You will be safe in following Dr. Mohr's directions. Dr. Hassall has written a work "On Urine," which will give you much information. You can also consult with advantage Lehmann's "Physiological Chemistry," Golding Bird's treatise "On Urinary Deposits," and Beale's treatise "On Urine, Urinary Deposits, and Calculi."

F. S. J.—To determine the sulphur in argillaceous iron ore, dissolve a weighed quantity of ore in nitro-hydrochloric acid, evaporate, &c., to separate the silica; dissolve the residue in acid; dilute, and precipitate the sulphuric acid with chloride of barium. The weight of sulphate of baryta obtained, multiplied by 0·13734, gives the sulphur.

X. Y. Z.—If you apply to our publisher, he will send the numbers you require, if they are in print. Occasional copies of our first and second volumes are to be met with; but they are worth far more than their publishing price.

A Miner.—It is not at all proved that our coal supply will run short for the next three or four hundred years, and in the meantime there will certainly be many discoveries made by which, if coal cannot be superseded altogether, its waste may be diminished. This is the most important problem; for nine-tenths of the coal raised is absolutely wasted, so far as the utilisation of the available force it is capable of exerting is concerned. Dr. Frankland, speaking of coal gas, says that physical science has yet scarcely attempted to estimate the true light-giving power of any sample of gas; but it can be proved, from the laws of conservation of force, that the light obtained by an argand burner is certainly less than the 1·265th of the light which could possibly be obtained from the same gas consumed at the same rate. Our problem now should be to try and get some of this enormously greater amount of light out of our gas. But we need not be dependent upon coal for gas. An ingenious Frenchman has lately propounded a brilliant idea. His theory (advanced through the medium of *La Gazette Médicale de Lyon*) is that all dead bodies of human beings are at present wasted, when they might as well be utilised by distillation into gas, to be used for illuminating purposes. He remarks:—"Coal is being exhausted, and since the human carcase is capable of supplying a gas of good illuminating power, why should it not be employed to this end? In India the idea is already realised. By a process of combustion in retorts a corpse of common dimensions may be made to yield twenty-five cubic metres of illuminating gas, which, at a cost of twenty-five centimes per cubic metre, would give a value of about eight francs for a body of ordinary size."

Communications have been received from C. Greville Williams; W. M. Bywater; H. Cross; J. W. Swindells; G. F. Rodwell; Sir B. C. Brodie, Bart.; S. Wilson; W. Odling; Rev. F. Souley Johnstone; S. Mordan; W. Briggs; C. H. Heaton; Dr. Adriani; T. A. Readwin; A. H. Church; T. Twining; Dr. W. S. Squire; A. C.; S. Mellor; Runcorn Soap and Alkali Company; R. E. Bibbey; S. Muspratt, M.D.; Hadland and Co., with enclosure; E. Parnell; T. L. Phipson, Ph.D.; Cearnen; W. Lang; E. Stock; Joseph Thorley; Wm. L. Carpenter; Samuel Johnson; E. Church; Dr. Lish.

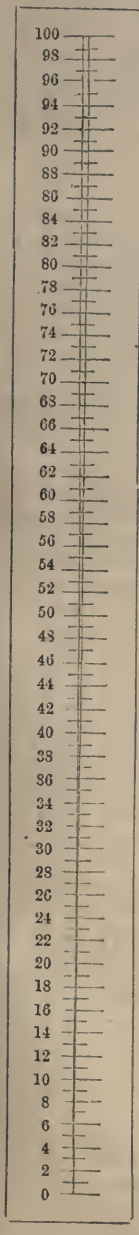
Books Received.—"Gas Manipulation," by U. T. Sugg; "An Index to Mineralogy: being an Alphabetical List of about 2500 Minerals, with concise References to their Composition, Synonyms, and Place in the British Museum," by T. Allison Readwin, F.G.S.; "A Guide to the Chemical Department of the Museum of the Royal Agricultural College, Cirencester. Part I.—The Mineral Collection," by A. H. Church, M.A.; "Science made Easy," by Thomas Twining, Esq.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Application of the Blowpipe to the Quantitative Determination or Assay of certain Metals, by David Forbes, *F.R.S., &c.**

(*Continued from page* 178.)

Determination of the Weight of the Silver Globule obtained on Cupellation.—As the amount of lead which can, by the method before described, be conveniently cupelled before the blowpipe, is necessarily limited, the silver globule which remains upon the bone-ash surface of the cupel at the end of the operation is, when substances poor in silver have been examined, frequently so very minute that its weight could not be determined with correctness by the most delicate balances in general use.



The blowpipe balance employed by the author turns readily with one-thousandth of a grain, but could not be used for determining weights below that amount.

Globules of silver of far less weight than one-thousandth are distinctly visible to the naked eye—a circumstance which induced Harkort to invent a volumetrical scale based upon the measurement of the diameters of the globules, which scale in practice has been found of very great utility in the blowpipe assay of silver.

The scale for this purpose which is employed by the author is shown in full size in the annexed woodcut.

This figure represents a small strip of highly polished ivory about $6\frac{1}{2}$ inches long, $\frac{2}{3}$ inch broad, and $\frac{1}{8}$ inch in thickness, on which are drawn, by an extremely fine point, two very fine and distinct lines emanating from the lower or zero point, and diverging upwards until, at the distance of exactly six English standard inches, they are precisely four-hundredth parts of an inch apart. This distance (six inches) is, as shown in woodcut, divided into 100 equal parts by cross lines numbered in accordance from zero upwards. It is now evident, if a small globule of silver be placed in the space between these two lines, using a magnifying glass to assist the eye in moving it up or down until the diameter of globule is exactly contained within the lines themselves, that we have at once a means of estimating the diameter of the globule itself, and therefrom are enabled to calculate its weight.

As the silver globules which cool upon the surface of the bone-ash cupel are not true spheres, but are considerably flattened on the lower surface, where they touch and rest upon the cupel, it follows that the weight of globules corresponding in diameter to the extent of divergence at the different degrees of the scale cannot be calculated directly from their diameters as spheres, but require to have their actual weight experimentally determined in the same manner as employed by Plattner.

The table here appended has been calculated by the author, and in one column shows the diameter in English inches corresponding to each number or degree of the scale itself, and in the two next columns the respective weights of the flattened spheres which correspond to each degree or diameter; for convenience these weights are given in the different columns in decimals, both of English grains and of French grammes.

These weights are calculated from the following data found as the average result of several very careful and closely approximating assays which showed that globules of silver exactly corresponding to No. 95 on this scale, or 0·038 inch in diameter, possessed a weight of 0·0475573 grains or 0·003079 grammes. From this the respective weights of all the other numbers or degrees on this scale were calculated, on the principle that solids were to one another in the ratio of the cubes of their diameters. This mode of calculation is not, however, absolutely correct in principle, for the amount of flattening of the under surface of the globule diminishes in reality with the decreasing volume of the globule. In actual practice, however, this difference may be assumed to be so small that it may be neglected without injury to the correctness of the results.

The smaller the diameter of the globule, the less will be the difference or variation in weight in descending the degrees of this scale, since the globules themselves vary in weight with the cubes of their diameters; for this reason, also, all such globules as come within the scope of the balance employed should be weighed in preference to being measured, and this scale should be regarded as more specially applicable to the smaller globules beyond the reach of the balance.

No. on scale.	Greatest diameter in inches.	Weight of globule in grains.	Weight of globule in grammes.
1	0·0004	0·00000005	0·0000000003
2	0·0008	0·00000044	0·0000000028
3	0·0012	0·00000149	0·0000000096
4	0·0016	0·00000355	0·0000000229
5	0·0020	0·0000069	0·00000044
6	0·0024	0·0000119	0·00000077
7	0·0028	0·0000190	0·00000120
8	0·0032	0·0000284	0·00000184
9	0·0036	0·0000403	0·00000262
10	0·0040	0·0000554	0·00000359
11	0·0044	0·0000736	0·00000478
12	0·0048	0·0000958	0·00000620
13	0·0052	0·0001218	0·00000789
14	0·0056	0·0001522	0·00000985
15	0·0060	0·0001872	0·00001203
16	0·0064	0·0002272	0·00001471
17	0·0068	0·0002725	0·00001764
18	0·0072	0·0003234	0·00002094
19	0·0076	0·0003804	0·00002463
20	0·0080	0·0004437	0·00002872
21	0·0084	0·0005137	0·00003327
22	0·0088	0·0005906	0·00003823
23	0·0092	0·0006748	0·00004367
24	0·0096	0·0007668	0·00004964
25	0·0100	0·0008667	0·00005611
26	0·0104	0·0009749	0·00006311
27	0·0108	0·0010918	0·00007068
28	0·0112	0·0012176	0·00007883
29	0·0116	0·0013528	0·00008758
30	0·0120	0·0014976	0·00009696
31	0·0124	0·0016524	0·00010698
32	0·0128	0·0018176	0·00011677

* Communicated by the author.

No. on scale.	Greatest diameter in inches.	Weight of globule in grains.	Weight of globule in grammes.
33	0·0132	0·0019934	0·00012817
34	0·0136	0·0021801	0·00014114
35	0·0140	0·0023786	0·00015397
36	0·0144	0·0025879	0·00016755
37	0·0148	0·0028097	0·00018190
38	0·0152	0·0030437	0·00019705
39	0·0156	0·0032903	0·00021302
40	0·0160	0·0035550	0·00022983
41	0·0164	0·0038230	0·00024751
42	0·0168	0·0041096	0·00026606
43	0·0172	0·0044111	0·00028553
44	0·0176	0·0047250	0·00030589
45	0·0180	0·0050546	0·00032725
46	0·0184	0·0053991	0·00034955
47	0·0188	0·0057590	0·00037285
48	0·0192	0·0061344	0·00039716
49	0·0196	0·0065258	0·00042250
50	0·0200	0·0069335	0·00044890
51	0·0204	0·0073581	0·00047638
52	0·0208	0·0077799	0·00050495
53	0·0212	0·0082580	0·00053464
54	0·0216	0·00873438	0·00056549
55	0·0220	0·00922854	0·00059748
56	0·0224	0·0097412	0·00063067
57	0·0228	0·0102725	0·00066506
58	0·0232	0·0108228	0·00070021
59	0·0236	0·0113922	0·00073753
60	0·0240	0·0119815	0·00077570
61	0·0244	0·0125901	0·00081513
62	0·0248	0·0132119	0·00085588
63	0·0252	0·0138901	0·00089797
64	0·0256	0·0145440	0·00094141
65	0·0260	0·0152311	0·00098623
66	0·0264	0·0159472	0·00103245
67	0·0268	0·0166828	0·00108010
68	0·0272	0·0174414	0·00112918
69	0·0276	0·0182220	0·00117974
70	0·0280	0·0190256	0·00123177
71	0·0284	0·0198529	0·00128535
72	0·0288	0·0207035	0·00134041
73	0·0292	0·0215782	0·00139704
74	0·0296	0·0224469	0·00145525
75	0·0300	0·0234010	0·00151504
76	0·0304	0·0243496	0·00157645
77	0·0308	0·0253224	0·00163950
78	0·0312	0·0263228	0·00170422
79	0·0316	0·0273484	0·00177060
80	0·0320	0·0284000	0·00183869
81	0·0324	0·0294789	0·00190852
82	0·0328	0·0305838	0·00198008
83	0·0332	0·0317162	0·00205340
84	0·0336	0·0328768	0·00212851
85	0·0340	0·0340649	0·00220549
86	0·0344	0·0349739	0·00228400
87	0·0348	0·0364422	0·00235938
88	0·0352	0·0378008	0·00244730
89	0·0356	0·0390138	0·00253168
90	0·0360	0·0404368	0·00261797
91	0·0364	0·0417943	0·00270790
92	0·0368	0·0431930	0·00279642
93	0·0372	0·0446162	0·00288860
94	0·0376	0·0460718	0·00298279
95	0·0380	0·0475573	0·00307900
96	0·0384	0·0465239	0·00317728
97	0·0388	0·0506249	0·00327759
98	0·0392	0·0522069	0·00338020
99	0·0396	0·0538215	0·00348452
100	0·0400	0·0554688	0·00359138

TECHNICAL CHEMISTRY.

On the Manufacture of Caramel Brown, by* Thos. Sherlock.

Caramel brown may be prepared in a variety of ways from glucose, molasses, or cane sugar. The following process gives a uniform and perfectly satisfactory article, and after having manufactured large quantities of the colour and tried several other processes, I have come to the conclusion that this is the best.

Provide an iron pan capable of holding twenty imperial gallons. Provide also an iron paddle or stirrer, flattened out broad at the end, about four feet long, and made light enough to be handled easily. Have also close at hand three or four gallons of clean boiling water. Set the pan on a ring over a fireplace, and put in half a hundredweight (56 lbs.) of good ordinary raw sugar. It is mistaken economy to use the very commonest brown sugar. Light a fire under the pan, and as it burns up stir the sugar about with the paddle. The sugar gradually melts, giving out puffs of vapour, and finally becomes a viscid liquid of a light brown colour. This is the first stage in the process. Only a moderate heat is required, and the melting should not be hurried. Now increase the heat gradually, stirring briskly and constantly. The liquid will become thinner and darker in colour, and at length begin to boil vigorously and rise up in the pan. The whole secret consists in the management of this part of the process, and minute attention should be paid to the following simple directions. Allow the melted mass to rise up till the pan is half full; then open the fire-door, throw water on the fire, and pull it out quickly. This should be done by a second person, the actual operator stirring sharply with the paddle to keep the mass in the pan. If the fire be drawn without first throwing water on it, the contents of the pan will inevitably boil over, and there will be a corresponding loss of product. Continue the stirring till the boiling subsides, and the dark brown mass lies quiet at the bottom of the pan. If a little be now dropped on to a cold plate or piece of metal, it will solidify to a brittle lump, of a clear rich brown colour, showing that the operation has succeeded. All that now remains is to add sufficient water to bring the mass to the desired consistence. The water must be boiling when added, and in very small quantities at a time. There is a considerable rush of steam as the first portions of water are stirred in, and care must be taken in using the paddle to stand clear of the hot particles projected from the pan; but after a few additions of water all this subsides, and the water may be added more freely.

The finished colour is usually sent out, either as a stiff paste-like extract, in which condition it is used by saddlers, curriers, &c., for browning certain kinds of leather, or as a syrup more or less thick. In this last form it is used for colouring vinegar, spirits, gravies, and many other liquids, and is well known in the drug trade as "color fuscus." If the stiff form be required, about a gallon of water will be sufficient, and in this case the product should be got out while hot, and put into stoneware jars, previously heated, and standing on a piece of wood.

Fifty-six pounds of raw sugar should yield at least 60 lbs. of the stiff colour, and proportionately more of the thinner kind, and when cold should dissolve readily in water, giving a clear brown solution, without deposit or turbidity.

* Communicated by the author.

The causes of failure in the manufacture may be either a deficiency or an excess of heat.

If the heat used be insufficient, some of the sugar remains imperfectly converted, and a muddy dirty-looking product is the result. On the other hand, if the heat used be excessive (strong heat is not required in any part of the process), the mass becomes black, granular, and insoluble in water—in fact, burnt and useless.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Group V.—Class 44: Chemical and Pharmaceutical Products.

M. Bobœuf, No. 9, Rue Buffault, Paris, the inventor of sodaic phenol, is an old acquaintance of ours. We have often enough spoken of him to permit us to say only a few words to-day. Along with phenol he exhibits magnificent specimens of phenic acid and picric acid manufactured by his processes. Thanks to him, the price of phenic acid has descended from 100 to 5 fr. the kilogramme; that of picric acid from 60 to 14 fr. His perfumed phenol, of which the odour is really agreeable, and the hygienic and preservative qualities are incontestable, will vie with the most popular toilet water and dentifrices. His phenol soap will certainly be useful in the therapeutics of skin diseases. It suffices to comb the head a few times with a comb dipped in a small quantity of phenate of soda, to cause all pimples, greasy or dry scurf, &c., to disappear. He obtained the Monthyon Prize, and a most favourable report was made by M. Kuhlmann in September, 1866, at the Mulhouse Industrial Society. These honours, joined to his commercial success, recommend M. Bobœuf to the attention of the jury.

M. Scipion Dumoulin, No. 5, Rue St. Claude, commenced, in 1820, by the preparation of unalterable ink, rendering forgery impossible; this ink was favourably reported upon, at the Academy, by Vauquelin and Deyeux. In 1842 he took out a patent for employing essential oils in a lamp, called the *gazomètre*, which was put into activity or stopped by means of a cock; it was a prelude to the Mille gazo-lamp, which was not possible in those days, as the lighter oils did not exist. In 1852 he devised a carburator, a vase or reservoir containing a spongy matter soaked in volatile essence for extra-carburising the gas passing through it. The means of procuring the gas without machinery is a secret discovered by M. Mille, by which the air or gas is charged spontaneously by passing over the volatile matters so as to be rendered more inflammable. In 1851 he communicated to the Academy of Sciences a new process for preparing picric acid by the reaction of nitric acid on the quasi-resin of canauba palms. This forms picric acid, and another part of the resin is transformed into wax like bees wax. The process is carried on with success in several manufactories of Lyons; the picric acid obtained is very pure, and is not greasy like the acid extracted from coal tar; it is very detonating, and explodes at the least shock. M. Payen repeats every year this experiment in his course of lectures.

In 1862 M. Dumoulin proposed to replace the oxide of lead glaze used for culinary purposes, at the potteries, by a glaze completely unalterable by alkalies and acids. Aided by a skilful potter, he thought at first he had realised the wished-for improvement, but it was otherwise; after a short struggle he gained the ground. He exhibited first in 1855 his liquid glue first discovered in 1850, which François Arago presented to the Academy on September 27, 1852, as solving a very difficult problem. The process was given voluntarily to the world by M. Dumoulin—it consists in pouring a small quantity of nitric acid into a solution of common glue or gelatin in its own weight of water. This glue, of two sorts, brown and white, is very strong, and is employed in private houses, workshops, and by jewellers, clockmakers, &c. Thousands of phials are sold abroad. To this liquid M. Dumoulin has added a cement insoluble in boiling water, and which rendered great service in the restorations at the Campana Museum. We may mention his cobalt green and blue, which were the first in France which really opposed the blues and greens of Saxony; his process of gilding and silvering without the battery, very easily and promptly effected by means of precipitated gold and silver, which render so much service in the jewellery art; his new ink, double black, prepared since 1853, without salts of iron, and incapable, therefore, of corroding the pens or paper, possessing from the first moment, and preserving indefinitely, its deep colour.

In 1860, M. Jean-Henri Chaudet, of Rouen, was the first to propose the use of bisulphite of soda or *leucogene* for wool bleaching, which is now universally employed in France, Belgium, Italy, Prussia, and Russia. In a tub filled with cold water, the first operation is to pour 18 litres of leucogene at 25° for every 100 kilogrammes of wool to be bleached. The wool, washed and scoured as well as possible, is steeped for at least three hours in this bath, and left to drain over the tub so as to save all the liquid. It is then dried in the open air. The same bath serves for any length of time, provided at each operation there are added nine fresh litres of leucogene per 100 kilogrammes of wool, with a sufficient quantity of water necessary to replace that used up by the preceding operation. The wools thus bleached have a whiteness which is permanent and more lasting than the bleaching obtained by sulphurous acid. They can enter into the manufacture of tissues and other goods without the slightest danger of injuring the most delicate colours. Leucogene is an excellent decolorising matter if used in the bleaching of vegetable textile matters, such as cotton, linen, hemp, jute, or phormium. It gives a silky white colour to threads and tissues, that cannot be obtained with the hypochlorites. M. Chaudet manufactures annually 140 tons of leucogene, representing 2000 tons of white wool.

In 1866 he conceived the idea of applying bisulphite of soda and indigo to the blueing of wools. He has rendered great service to manufacturing arts by introducing an agent for permanently dyeing white wools blue by sulphurous acid. The process is extremely simple. All that is necessary is to add to the ordinary leucogene bath from three to five parts by weight of blue dye for every 100 kilogrammes of wool to be bleached. The operations of dyeing and bleaching take place simultaneously.

In the course of 1865-66, M. Chaudet effected another improvement in the industrial arts. Up to that time chromium was only employed as a mordant in the state of chromate, in which it acted the part of an acid. The colouring matter was often burnt by the oxygen of this acid, and the tints obtained changed rapidly when exposed to the air. By substituting for the chromate other salts in which chromium acted as base, new and permanent effects have been obtained. The salts used by M. Chaudet are the sulphate, the nitrate, and the oxalate of chromium. They are employed in the same manner as the salts of alumina. In copper vessels, 4 or 5 by weight of sulphate of chromium, at 62° Beaumé, are dissolved as mordant for 100 of wool. The liquid is raised to a boiling point and left to simmer for two hours. The stuff is then washed and rinsed as usual. For vegetable substances, such as flax, cotton, or hemp, the bath is composed of a solution of nitrate or oxalate of chromium, marking 1½° to 3° Beaumé. It is stove-dried, rinsed, and dyed. For printing, the ordinary method of operation is not changed, except that the acetate of alumina is replaced by the nitrate or oxalate of chromium, or the sulphate of alumina by the sulphate of chromium. With the salts of chromium as mordants, new shades of colour are obtained of a solidity before unknown.

M. Chalmel, of Paris, exhibits a preservative varnish, used by all the great silversmiths and goldsmiths of Paris. This varnish is also very serviceable for copperplate engraving. He also exhibits an excellent green for water-colour drawings, miniatures, &c.; and oil of turpentine and lavender for the vitrification and incorporation of colouring matters on marble, porcelain, crystal glass, &c.

M. Bourgeois-Rocques, of Ivry (Seine), has adopted a singular method of manufacturing essences of wine. He sells it in small phials to vendors of natural and artificial liquids for the purpose of giving the colour, aroma, and "bouquet" of first-class wine crops, and of the best growers. For example he gives to the most ordinary white wines the perfume and taste of Sauterne.

The widow Madame Audouin, of Paris, exhibits a species of marine glue, which is susceptible of being put to an immense variety of uses. The forms are very variable—black glue, resisting the action of salt water; red, replacing minium; yellow, for staining wood; and soldering glue for sticking together wood, metals, glass, or porcelain.

Chemical and Pharmaceutical Products in the British Section.

(From another Correspondent.)

In giving a short account of the chemical and pharmaceutical products of British manufacture in the French Exhibition, our object will, in the first place, be to state what the substances exhibited are, and in the next, whenever possible, to glance rapidly at the chemical reactions and principles involved in their production.

We need scarcely say that in a vast number of instances the Exhibition has simply been used as a means of advertising goods of no scientific merit whatever. In an almost equal number of cases the goods shown are devoid not only of all claim to the interest of scientific men, but are not even remarkable as representing any advancement in either manufacturing skill or inventive resource. In addition to these there are many instances where there are no means whatever of forming a judgment as to the quality of the substances exhibited. We allude to compounds and mixtures in liquid or powder, the true composition of which is a secret known only to the manufacturer. The chemical and pharmaceutical products form Class 44 of the Exhibition Catalogue; they are contained in Gallery V. of the building, and have been thus classified:—

Acids, alkalies, salts of all kinds, sea-salt, and products extracted from mother waters.

Various products of chemistry; wax and fatty substances, soaps and candles, raw materials used in perfumery; resin, tar, and the products derived therefrom; essences and varnishes; various coating substances, blacking, india-rubber and gutta percha and their products; dyes and colours.

Mineral and sparkling waters, natural or artificial.

Raw materials used in pharmacy, simple and compound drugs.

We shall take them as nearly as possible in the order in which they occur in the Catalogue.

The first exhibitors whose case we shall notice are the well-known firm of Allen and Hanburys, of Plough Court, London. They exhibit only two articles—viz., cod-liver oil and Liebig's extract of meat. Of the first of these two there are samples manufactured in London and in Norway, both with the stearine, and also with so much removed as will crystallise out at ordinary temperatures.

Messrs. Allen and Hanburys inform us that they commenced the manufacture of cod-liver oil as early as the year 1843, and according to the directions then recently published by Professor Donovan. They have continued the manufacture regularly since that date, both in London and abroad, with only slight modifications of the original process. The oil is of a pale straw colour, and, when first made, has a seaweed-like odour, which, however, cannot long be preserved, no matter how carefully it has been prepared. Donovan's process, according to Cooley, is as follows:—"The perfectly fresh livers are placed in a metallic vessel and heated with constant stirring to 180°F., by which treatment they break down into a uniform pulpy liquid mass. This mass is immediately transferred to calico bags, whence the oil drains out; after filtration, while still warm, this oil is sufficiently pure for use."

Cod-liver oil is now so much used in medicine, that it has become a highly important article of commerce.

In this country we are inclined to look with more or less of suspicion upon any name that is connected with a largely advertised medicine. It is impossible to deny that the lustre of one of the most brilliant names in chemical science has been somewhat dimmed, at least in the eyes of the world, by being continually seen attached to jars of a highly nutritive but certainly uninviting-looking preparation in great favour at the present moment with the debilitated and dyspeptic.

This circumstance, although certainly unfair, is absolutely inevitable. There are few, therefore, who read the advertisements of "Dr. De Jongh's light brown cod-liver oil," who are aware that that gentleman (who, from the pertinacious way in which he has been decorated, appears to be a favourite with kingly amateurs of cod-liver oil) published in 1843 a most laborious research on the substance alluded to.

That cod-liver oil is a valuable remedial agent in numerous diseases of a scrofulous type is now so generally conceded that it would be a waste of time to argue the point. To which of the numerous ingredients detected by De Jongh we ought to attribute the active properties of the oil, is another matter. We need hardly say that the wildest views are entertained on the subject, especially by medical men, whose chemistry, as a general rule, is disgracefully defective. The subject is so important that we shall make no apology for quoting the analyses of the authority we have named. It is true that they show weak points, especially as regards the bile ingredients; the defects, however, are more easy to point out than to remedy, and, at the time the analyses were made, were not so obvious.

	Brown.	Light brown.	Pale.
Oleic acid (with gaduine and two other substances)	69·78500	71·75700	74·03300
Margaric acid	16·44500	15·42100	11·75700
Glycerine	9·71100	9·07300	10·17700
Butyric acid	0·15875	—	0·07436
Acetic acid	0·12506	—	0·04571
Fellinic acid and cholinic acid, with some margarine, oleine, and bilifulvine	0·29900	0·06200	0·04300
Bilifulvine, bilifellinic acid, and two peculiar substances	0·87600	0·44500	0·26800
A peculiar substance soluble in alcohol of 0·968 sp. gr.	0·03800	0·01300	0·00600
A peculiar substance insoluble in water, alcohol, and ether	0·00500	0·00200	0·00100
Iodine	0·02950	0·04060	0·03740
Chlorine and traces of bromine	0·08400	0·15880	0·14880
Phosphoric acid	0·05365	0·07890	0·09135
Sulphuric acid	0·01010	0·08595	0·07100
Phosphorus	0·00754	0·01136	0·02125
Lime	0·08170	0·16780	0·15150
Magnesia	0·00380	0·01230	0·00886
Soda	0·01790	0·06810	0·05540
Iron	traces	—	—
Loss	2·56900	2·60319	3·00943
	100·00000	100·00000	100·00000

It is not remarkable that so many persons should entertain unsound views regarding the causes of the efficacy of cod-liver oil. Dr. De Jongh considers the value of the oil to be derived from the iodine and the elements of the bile. Others have imagined its curative properties to reside in the bromine, others in the phosphorus. It appears to us that these views are sufficiently refuted by the fact that none of the attempts to administer the ingredients of the oil in a separate state have succeeded. It is true that it has been attempted to evade this difficulty by saying that in cod-liver oil the substances alluded to are in a peculiar condition in which they are especially prone to assimilation. There is not the slightest evidence that this is the case. The free phosphorus has had the credit of being the really valuable ingredient. But is it absolutely certain that the phosphorus in cod-liver oil is free? Unless we are mistaken, the evidence for the existence of free phosphorus rests upon the fact that more phosphoric acid is obtained after oxidation of the oil with nitric acid than is obtained by precipitation from the liquid separated from the fatty acids after saponification. We think the evidence for the existence of free phosphorus requires to be greater than this. But, even assuming the fact, we think it in the highest degree doubtful if cod-liver oil, even if of the most absolutely correct "light brown" tint, possesses any remedial virtues save what are due to the fact of its being a highly digestible fat oil; and we consequently contend that the coloured and fœtid oils possess no curative properties that are not found in the carefully prepared and consequently nearly colourless oils—nay, more, that the disgusting flavour of the foul fish-oil of commerce, by rendering it more loathsome, in the same ratio renders it more difficult to assimilate.

PROCEEDINGS OF SOCIETIES.

ROYAL INSTITUTION.

Tuesday, May 21, 1867.

A Course of Four Lectures on Spectrum Analysis with its Applications to Astronomy, by* William Allen Miller, *M.D., LL.D., Treasurer and V.P.R.S., Professor of Chemistry, King's College, London.*

Lecture II.

(*Continued from page* 278.)

Before I quit this part of our subject, I wish to show you that in particular cases the same gas may give two different spectra. If you send an electric spark through one of these exhausted tubes of nitrogen at a low temperature, you will obtain a spectrum of a particular kind, but the same gas will exhibit at a higher temperature a spectrum which is quite different. This is one of the most important discoveries with reference to gaseous spectra which Plücker has made. Here is a nitrogen tube arranged on a whirling table for imparting to it a rapid rotary motion. Nitrogen is a substance which, at a low temperature, emits a golden yellow light, and this, when examined by the prism, is seen to consist of a series of bands in the less refrangible part of the spectrum. If the temperature is raised—as by sending a spark from a large Leyden jar through the tube—the light becomes of a bluish or violet colour, and then the character of the spectrum is seen to be entirely altered. I can only show the alteration in the colour and the duration of the light at the two different temperatures. But as I cannot show you the spectra of the gases upon the screen, I have endeavoured to obtain a substitute by employing the aid of the photographer; and if this photograph be placed before the lamp we shall be able to project upon the screen a representation of the different spectra which Plücker has figured. I shall give you first the series of bands which are produced at low temperatures, directing your attention first to nitrogen, a material which is of special interest to us, inasmuch as it is the most abundant constituent in our atmosphere. You will observe particularly the spectrum of nitrogen, and notice the peculiar way in which the bands are distributed. It is found that these bands are made up of a great number of fine lines closely aggregated together. The spectrum becomes more feeble towards the refrangible end, and at this point in the violet it suddenly ceases. This is the nitrogen spectrum at the lowest temperature. Plücker and Hittorf (who made their experiments together) call this the nitrogen spectrum of the first order. I now wish to show you, in contrast to these lines, the effect which is produced by sending through the same gas a spark at a high temperature; here we have a series of brilliant bands so produced, forming a spectrum quite different from that of the same gas at a lower temperature. So also in the case of sulphur the spectrum at a high temperature is of a very different nature from that which the same body exhibits at a lower temperature. This is true also of selenium, though I have not the spectrum of selenium at the lower temperature to exhibit to you. These cases, in which the character of the spectrum changes with the temperature, are the exceptions. In the case of oxygen there is no such change, neither is there in the case of phosphorus, chlorine, iodine, bromine, and arsenicum.

These differences are very important when viewed theoretically, though as yet we have no satisfactory explanation of them. It has been supposed that where two spectra occur the bands formed at a low temperature are produced by a substance which is really different from that which gives rise to the bands which are given out by what appears to be the same body at an intense heat. It has been conjectured, though it is by no means proved, that substances which, like nitrogen, sulphur, and selenium, give two different spectra, are not elementary bodies, but that at the high temperature they are actually separated into their components, just as we recently separated chlorine from barium, and carbonic acid and oxygen from the same metal. But this conclusion is by no means well established, because it is seen that the moment we cease to pass the electric spark, the whole thing is as it was before; and if the substance has been decomposed by the intense heat, it has been as instantly recomposed on the diminution of temperature. Professor Stokes has suggested that the degree of rapidity in the vibration of the particles of the substance is connected with the different duration of the electric discharge in the two cases, and that a higher intensity of the electric spark gives to the nitrogen, for instance, the power of producing a higher series of vibrations than it can furnish when heated for a longer period to a lower degree. At present, however, that is a point for further investigation. We do not know why it should be that certain elements, if they be elements, should be thus altered, and certain others should not experience a like change under circumstances apparently similar. It is, however, an extremely curious fact, and has an important bearing upon the application of observations of this nature to the interpretation of astronomical and other phenomena.

There is another fact with regard to the spectra of gases which, as I am now upon that subject, I may mention here. Plücker observes that, although in the case of solid bodies you may generally distinguish the presence of small quantities in admixture with others, it is not easy to do so in the case of gases. You may have a notable quantity of one gas added to another, and yet the spectrum will be only that of the predominant gas. It is not so in the case of solids. For instance, if you heat an alloy of gold and silver by the electric spark, the gold gives a spectrum in which you have also the characteristic lines of silver superadded, although the proportion of silver may not exceed one part in a hundred.

* Reported specially for this paper, and revised by the author.

I wish to show you, if I can, the effect that is produced by examining two spectra at the same time. My object now is to give an idea of the principle upon which two different spectra are compared with each other. You must, if you please, be indulgent to me if I should not succeed, because I believe this is the first time this has been attempted before a public audience. I have here two lanterns, and I wish so to arrange them as to throw upon the screen at the same instant two spectra passing through the same lens and the same prisms. [The spectra were produced as desired.] These are the spectra of lithium and of strontium; and I have selected these two, because in each case the colour they communicate to flame is so similar that they are not capable of being distinguished from each other, if viewed without the aid of the prism. Both bodies tinge the flame of a brilliant red colour. But by means of the apparatus which we have here, we see at once that the position of the lines in the two cases is quite different. We have the crimson line of the lithium on the edge of the screen. Then we get the orange line and the blue band as the temperature rises, and you will observe that there is a blue band given by the strontium, very near the same position as that of the lithium line. It is so near that when it was observed for the first time in this theatre the remark was made, "Oh, that must be a mistake: you have taken strontium instead of lithium." But you see, when we compare the two, there is no doubt whatever about the difference. Mr. Fox Talbot was the first to point out the fact, more than thirty years ago, that lithium and strontium compounds could be immediately distinguished by the aid of the prism.

The apparatus which we use for the purpose of comparing spectra for philosophical purposes is not liable to any of the uncertainty which an extempore arrangement for projection on the screen is liable to entail from the overlapping of the two spectra. In the spectroscope, when properly arranged, the two spectra are presented to each other edge to edge with the greatest possible accuracy, and I must now endeavour to show to you how it is that this measuring apparatus is used.

We want, for example, to make an examination of the residue of a water which has been boiled down, and we wish to ascertain if, among other things, there is any strontium present in the salts. For this purpose we make an experiment precisely similar in principle to that which I made just now upon the screen. We take a salt of strontium, and we arrange it so that, by means of the apparatus at our disposal, we can transmit the light from the strontium flame through the instrument. It enters the tube at a narrow slit, and passes along it until it falls upon a lens. Placed at just such a distance from the slit as to render the beam of light parallel, the sheaf of parallel rays immediately falls upon the prism behind the lens; and when the light comes out on the other side of the prism, it is separated into the coloured bands of strontium. The observer does not throw these upon a screen like the one we have been using, but upon a far more sensitive screen at the back of his eye—the retina. To bring these lines to a focus, there is a small telescope arranged behind the prism, fitted with a sliding tube for adjusting the focal distance. The light from the other flame also passes through the same slit. If I introduce a little salt from some of the Bath waters, for example, into this flame, I immediately colour it. We place the second flame opposite to a small right-angled prism, which is so small that at a distance you do not see it in the instrument; but it is so arranged that it shall cover just half the slit. In this case the prism is used simply as a reflector, which directs the beam down the axis of the tube. We have, then, two beams passing through the same prism and the same telescope, and falling upon the eye at the same moment. They are so adjusted, however, that their spectra shall meet edge to edge. If we do this, then we have a means of making the spectrum of the strontium compare itself with that of the substance we place in the second flame.

If I take, as I will do now, a little of the residue from the Bath water, and make its spectrum fall upon the screen, we shall have a very complex image. There is the yellow line of sodium; there are green bands; I believe there is a little strontium; and there are the bands of calcium. Here is a line which is very like the lithium line. We will put some lithium into the other lamp, and see whether that gives the same line. We can compare spectra in this way one with the other; and if the bodies we introduced into the second flame are present in the original substance which is being examined, certain lines of its spectrum will run into each of the lines of the spectrum with which it is being compared, thus proving that the body compared is present in the original substance. In other words, we take a substance the composition of which is known to us, and we compare its spectrum with the spectrum of a body the composition of which is unknown to us.

Each of the earths has a spectrum of its own, which I would show you if time allowed, but as that is not the case, I must make the best approach to it that I can by exhibiting a photograph of the spectra of those bodies.

This is the characteristic line of potassium—a double line in the red. Then there is a diffused light in the middle, and here we have a blue or violet line near the most refrangible extremity, indicating potassium. Potassium is not distinguishable in such small quantities as some other metals. Here is the spectrum of rubidium, a metal which was discovered by means of this method of analysis. Bunsen was examining the water of the Durkheim spring, and he found he had a double red line which he had not seen before, and some lines in the blue which he had also not seen before. These were the lines of substances which he had not previously met with; and although in the original water only between three and four grains of the substances were present in a ton of water, yet, relying upon the accuracy of the indications which he had obtained in the spectrum, he procured a large quantity of the water, boiled it down, and succeeded in isolating these two bodies. One of them he called rubidium, from the occurrence of these red lines, and the other cæsium, so named from the occurrence of two bright lines in blue. In addition to these, two other metals have also been discovered by the aid of the prism; one of them —thallium—I have already mentioned, and you have seen the green line by the occurrence of which the metal was discovered by Mr. Crookes as he was examining a particular substance, of which he possessed but a small quantity. The difficulty then was, first, to find out in what minerals it existed, and next to devise chemical means of obtaining it. These difficulties have been overcome, and it can now be procured in considerable quantities. I have seen masses of it weighing 30 lbs. I have quite recently heard that carbonate of thallium has been introduced by M. Lamy into the preparation of glass, which is said to be superior to any hitherto used for optical purposes.

The short remainder of the hour shall be devoted to the examination of the spectra of these metals, which were originally discovered by the aid of the spectra themselves. We will first project upon the screen that of cæsium. You will probably see several lines, but the characteristic lines are those two blue lines now visible, one of them considerably brighter than the other. These are the lines more particularly distinguishable at low temperatures. There are also a number of lines in the red. In showing you these bodies in the voltaic arc, I am working under considerable disadvantage, because, at so high a temperature, the spectra are much less simple than they are at lower temperatures. At high temperatures many of these bodies, as I have said, acquire the power of vibrating with different degrees of velocity, in consequence of which additional

bands corresponding to these new velocities of vibration are developed at a high temperature, but they do not lose the power of vibrating with the definite velocities which they acquired at a lower temperature; they therefore preserve the bands originally seen, as well as those produced by the intense heat applied.

We will now throw upon the screen the rubidium spectrum, using the chloride of the metal. In this case the chlorine is separated from the rubidium. If the spectrum is a good one, we shall have a double red line upon the less refrangible edge of the spectrum. Here is the rubidium line, accompanied by the paler bands in the blue. The double red line is the characteristic portion to which the body owes its name, from *rubidus*, dark red. This is very different from the spectrum of cæsium, where the blue lines were particularly prominent. The brightness of the blue lines in rubidium is not to be compared with that of the line in the red.

I shall conclude by showing you one of the latest fruits of spectrum analysis—a substance characterised by two remarkable lines in the blue. The name of "indium" has been given to it, because it gives a light of an indigo-blue colour. These bands are at the violet end. Here is the spectrum of this body. I am indebted to an old friend, Professor Varrentrapp, for this sample of indium, who has sacrificed half his specimen in order that I might be enabled to show you these bands. It is a substance scarcely to be obtained, although in the Paris Exhibition there is a mass of upwards of a pound weight of it, but it is there at present in prison as an exhibit.

ROYAL DUBLIN SOCIETY.*

At the last evening meeting of the Royal Dublin Society, Dr. Emerson Reynolds read a paper upon "*An Isomer of Sulphocyanogen.*" If the new body which he has discovered proves, on investigation, to be really an isomer of the theoretical radical, CyS, the communication will be one of the most important contributions received for some time in connexion with organic chemistry. The author, having referred to the fact of sulphocyanogen never having been isolated, dwelt at some length upon the different views that had been taken by workers with the subject, particularly as regards the composition of the sulphocyanides. These views may be enumerated in a few words. 1. We have the radical theory. In this theory the existence of the salt-radical, CyS, is admitted, and we may look upon the ammonium salt as NH_4,C_2NS_2. This molecular arrangement is the one that is generally accepted. 2. The composition may be viewed as a sulphide of ammonium combined with sulphide of cyanogen, thus—NH_4S,C_2NS. 3. The body may be viewed as sulphuretted urea, or as a sulphocarbamide. The relation to urea is represented in the two following formulæ:—

$C_2N_2H_4S_2$ — Hydrosulphocyanic acid. $\qquad$ $C_2N_2H_4O_2$ — Urea.

Gladstone (*vide* Watts's Dictionary, vol. v. page 505) has also noticed that sulphocyanic acid, together with urea (carbamide), is formed by the action of sulphuretted hydrogen on ammonio-cupric fulminate. Dr. Reynolds referred to all these views, but stated that the first was the accepted one.

Now, when sulphocyanide of ammonium is submitted to destructive distillation, it is split up, according to Liebig, into bisulphide of carbon, sulphuretted hydrogen, ammonia, and a residual substance, which that chemist has named melam. This latter substance is afterwards converted into hydromellone—

$$8(NH_4,C_2NS_2) = 4CS_2 + 8HS + 5NH_3 + \underbrace{C_{12}N_{11}H_9}_{\text{Melam.}}.$$

$$C_{12}N_{11}H_9 = 2NH_3 + \underbrace{C_{12}N_9H_3}_{\text{Hydromellone.}}.$$

When, in the presence of water, sulphocyanide of ammonium is submitted to the action of heat, Dr. Reynolds says that it gives

$$NH_4,C_2NS_2 + HO = \underbrace{C_2NS_2H}_{\text{Hydrosulphocyanic acid.}} + NH_4O.$$

But he finds that heat, in the absence of water, produces

$$NH_4,C_2NS_2 = NH_3 + H + \underbrace{C_2NS_2}_{\text{Isomer.}}.$$

The latter is purified by recrystallisation. It is a very stable compound, which will bear a considerable temperature without decomposition. The analysis gave figures that corresponded to C_2NS_2.

The following compounds were described:—

Bichloride of platinum gives a red crystalline precipitate, having the following composition—$C_2NS_2PtCl_2$. It will be seen at once that this compound does not follow the type of the ammonium salt, but accords with the composition of urea.

Nitrate of silver forms a compound, a direct combination of the salt with the isomer.

There is also a mercurial salt, $C_2NS_2,HgCl_2$.

The author said, in conclusion, that we might naturally expect to find an isomer of sulphocyanogen, as such changes seem to be a natural property of the cyanogen compounds. Thus, he gave as instances the three chlorides of cyanogen, and the paracyanogen procured on submitting cyanide of mercury to destructive distillation.

As the author used the old notation, we do so in our report.

* Specially reported for the Chemical News by Charles R. C. Tichborne, F.C.S., &c.

QUEKETT MICROSCOPICAL CLUB.

Friday, May 24.

Mr. Ernest Hart, *President, in the Chair.*

The ordinary monthly meeting was held at University College.

A paper was read by Mr. M. C. Cooke "*On Binocular Vision.*"

The President read a paper "*On the Minute Structure of the Iris and Ciliary Muscle,*" in the course of which he demonstrated the structure and direction of the ciliary or accommodative muscle of the eye in man, ruminants, and birds, and showed that there are presented no circular or sphinctral fibres in the latter, and discredited their existence in the former. The paper was illustrated with enlarged diagrams, and numerous injected specimens under the microscope. The meeting, which was fully attended, terminated with a *conversazione*. Ten members were elected.

ACADEMY OF SCIENCES.

May 27, 1867.

M. L. D. Girard presented and described a new ball governor, giving perfect isochronism and acting instantaneously upon the steam valve. He maintains the balls in any position by giving to the motor a constant velocity, and also an angular velocity equally constant. He proves by calculation that the four-balled regulator, when in equilibrium, is isochronous; that it does not follow the mathematical laws of the conical pendulum of Watt; that it can be applied without any change to all machines.

M. Felix de Luca placed upon the table in the name of his brother Dominique de Luca, director of the ophthalmic section of the "incurable" hospital at Naples, a note "*On the Employment of Sulphate of Soda in the Treatment of Spots on the Cornea.*" After having mentioned the inefficacy, inconvenience, and at the same time the dangers of the known methods—laudanum, alcoholic or tannic liquids, &c.—he thinks that crystallised sulphate of soda, by reason of the property it possesses of maintaining in solution the fibrine of the blood, can exercise a favourable action on spots in the cornea. In

the first experiments use was made of an aqueous solution of sulphate of soda saturated in the cold; it was let fall drop by drop on the eyeball. The spots diminish in extent, but with an excessive slowness. For the solution M. de Luca substitutes the sulphate reduced to a fine powder, which he lets fall by pinches on the eye twice a day, the head resting nearly horizontal. The salt is dissolved by the humours of the eye, at the same time producing an agreeable sensation of cold. At the end of a few days the spots commence to disappear, and the patients, who could not see at all, distinguish the movements of the hands and fingers, and the blindness soon ceases.

NOTICES OF BOOKS.

Analysis, &c., of Coal Gas. By Rev. W. R. Bowditch, M.A., F.C.S. London: E. and F. N. Spon, 16, Bucklersbury. 1867.

Nothing in the history of chemistry offers a parallel to the extraordinary series of results obtained by the close study of the products of the distillation of coal. The matter has been treated by almost every chemist of eminence, and an endless series of new products have enriched the philosopher, chemist, physician, economist, photographer, and dyer. No worthier or abler historian of coal gas, as regards its purification and use could well be found than Mr. Bowditch, who has, year after year, by his discoveries fairly earned the name of a public benefactor. The chemical reader will obtain from Mr. Bowditch facts not to be found elsewhere, and before unknown to him, and also a more forcible expression of fragmentary knowledge contained in scientific works, in which diffusion of matter is so often unavoidable, and whose only remedy is a compilation of this kind. The book is of necessity, as regards its mass, a compilation, but it is also a comparison of the author's own results with those of other authors, whether antecedent or subsequent.

Perhaps the greatest, certainly the most obvious, of the benefits for which we have to thank Mr. Bowditch, is the attention that he has drawn to the effects arising from carburetting or naphthalising gas. Indeed, if we mistake not, the spirit of the present work points to a division of labour—to operations necessary at the place of manufacture, not to be confused with others more expedient at the place of consumption—but a strong and forcible expression of this is wanting. On the question of carburetting gas, we find: "The large proportion of carbon in naphthalin pointed it out as being fitted to yield much light with little heat, if it could be burnt. But only a short time ago it was the prevailing opinion among chemists that naphthalin could not be so burnt. At the instant of liberation it crystallises, and so clogs the pipe, being regarded by the manufacturer as a waste product only—and a very inconvenient one too. Experiment also proves that ordinary gas at common atmospheric pressures and temperatures has no power to combine with the crystallised naphthalin." With these facts in mind, Mr. Bowditch contrived an apparatus, which he fully describes, on the principle of using naphthalin when in an available state—*i.e.*, not as a solid; and this object is effected by the gas burner itself, which so by its own waste heat supplies to itself increased light—a simple device, but, as will be shown, of great practical application. Carbolen is used for the apparatus, a commercial general term for these heavy oils, differing so little from naphthalin that the latter, as being a definite chemical body, is taken as its type. A gallon of this, weighing 10 lbs., costing 2s. 6d., yields a light of 14,000 candles. As a simple tabulated result we find—

	Weight burnt.	Light.	Cost. £	s.	d.
Naphthalin .	10 lbs.	14,000 candles	0	2	6
Gas . .	280 lbs.	14,000 ,,	1	17	4

For equal *weights* the heating powers of gas and naphthalin are as 12000 to 8786. But add to this fact one more important still—or rather the sister fact to it—viz., that all the carbon added by the method gives light, and so lessens the amount of gas used. No unnecessary carbonic acid being formed from the marsh gas and carbonic oxide unused (if not carburetted) for lighting purposes, the smaller quantity of carbonic acid, of course, as will be at once seen, is not so as a total result, but is so per unit of light, an excess of the material being thus avoided.

The reader will grant also to the author his other two statements of minor importance—first, the greater steadiness of carburetted light; for "highly carburetted gas cannot be burnt without burners of small aperture and under considerable pressure, without smoke and diminished light"—these are the very conditions of a steady light. The second point is that by the light of carburetted gas we can distinguish colours with almost the same ease, distinctness, and accuracy as by daylight—this as a result of quality, not of mere quantity of light.

This also the chemist might expect; but he could not expect the following strange result:—"In fact, the spectrum of my light approaches the spectrum of sunlight more nearly than that of any other artificial light does." The materials used by the inventor of the apparatus are cymol and naphthalin—both very cheap and abundant. As regards the safety of these materials, "they will not burn alone, but require the heating power of a combustible gas to sustain the combustion. When lighted matches, candles, &c., were plunged into the materials at 100° C., the lights were extinguished as they would have been by immersion in water, and in no instance were the hydrocarbons ignited." The officers of insurance companies state that they are unacquainted with anything in use as an illuminant which is so safe. To conclude the question, Laurent has found that naphthalin thrown into a red-hot crucible volatilises undecomposed, and condenses in the air in snowy spangles. For our part we should like to know if any purification of the so-called carbolen is required for the separation of the sulphur which is taken up by naphthalin in very notable quantity, and what is the extra cost involved by such purification. If the crude oil is to be used, it would be necessary to purify from sulphur at the place of manufacture; otherwise, for the same amount of light, if the carbonic acid be less, the sulphurous acid will be more, and poisoning by the former is preferable to the same result by the latter, with less general destruction of property.

We have followed Mr. Bowditch so fully in this portion of his work that we cannot treat other most interesting subjects at the same length. It is sufficient to say that the same comprehensiveness and enthusiasm in the subject are features common to every chapter. A full history is given of M. Berthelot's synthesis of acetylen, and the great chain of results hanging upon that discovery up to the time when the book went to press. One fact, stated in a very modest way, will doubtless be thought worthy of greater interest by insurance companies. We allude to the proved gnawing of gas-pipes by rats as a probable explanation of sudden gas explosions, caused, of course, as it was formerly said, by carelessness in turning off the gas. A diagram of a pipe so injured is appended. An iron pipe it was; but the dangers attending lead are of course much greater.

Methods are given *seriatim* for tar-testing in coal gas. "Some of the oils so dissolved from gas are of such a high boiling-point that they cannot be distilled, except at a temperature which *softens Florence flasks*, and their density is far greater than [that of?] water." Kraut's flame-test for ammonia in gas by combustion is quoted from the Chemical News, No. 311; also, Dr. Hofmann's original demonstration of the inflamma

bility of ammonia. The author remarks:—"I must caution inexperienced manipulators against buying their test-papers. I have seen purchased turmeric paper, held in a full stream of scandalously ammoniacal gas for more than a minute, remain perfectly unaffected; whereas properly made paper became red-brown in a single second. Managers and boards of directors have been so known to have been deceived."

As regards the difficulty of obtaining tri-ethy-phosphine for testing for bisulphide of carbon, it is remarked that it is not sold as an article of commerce, and only experienced chemists can make it. Mr. Bowditch has known 5*l.* to have been offered and refused for an ounce of this compound. It is therefore practically inapplicable as a test. This makes Mr. Bowditch's own test for the same compound by solution in alcohol, and subsequent dilution by water, the more valuable. A figure of the necessary apparatus is given, with a full description. The author has also thrown much light upon sulphur generally in gas, founded upon the power (as our readers doubtless remember) of heated lime to *act upon all* the sulphur compounds in gas. Of course, the origin of such sulphur is not learnt thus. As regards sulphur testing, we come to some statements that will be of the greatest interest to chemists. "I have passed this sulphur compound into *nitroprusside of sodium* for some time, and have *failed* to have obtained any indication of the presence of a sulphide; and *yet lead paper has been coloured.* I think I can name the compound, and, indeed, I have done so to friends in private; but as I am not prepared here to give proofs of the accuracy of the conjecture, I forbear." Also, from steps in the process specified, the author continues:—"I therefore conclude that the blackening of the lead paper in the above case was not due to hydrosulphocarbonic acid, but to some unknown or unsuspected compound."

Mr. Bowditch has found by experiment that when the test candle is thinned, *either an increase or decrease* of consumption may result—which is very satisfactory to us, for it serves to show that, apart from the clumsiness and inaccuracy of expression involved by the use of the term "so many candles," a positive radical evil attends their use. Arago by his photometer was on the more trustworthy track, and to his method, improved so as to be practically worked, all experience tends to point. The author gives us the outline of a new and ingenious scheme for the improvement of the use of candles, which he calls "the new photometric candle balance and elevator;" we hope, however, that he will turn his energies to the question of examining light by any refractive or polarising means, admitting of a concise expression of results. It will not be the first time that Mr. Bowditch will have rendered a useful original process useless by a subsequent and more perfect one.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Zeitschrift des Architecten und Ingenieur-Vereins für Hannover. No. 4. 1866.

Von Kaven "*On the Elasticity and Tensile Strength of Iron and Steel.*"—Reder "*On the Action of the Atmosphere on Coal.*"—F. Rziha "*On the Cost of Manufacturing Cement.*" — Oppermann "*On Romain-Lavaud's Glass Manufactory at la Villette, Paris;*" "*On Guillaumet's Dye Works at Puteaux-sur-Seine.*"—A. Wöhler: "*Results of Experiments on the Relative Strength of Iron, Steel, and Copper.*"

Dingler's Polytechnisches Journal. No. 3, February, 1867.

A. von Waltenhofen "*On the Electro-motive Force of certain Voltaic Batteries.*"—R. Wagner "*On the Quantitative Estimation of Tannic Acid.*"—A. Ott "*On Petroleum as a Lubricant.*"—F. Kick "*On a Cheap and Rapid Method of Preparing Lecture Diagrams.*"—"*On Keeping Sodium in Paraffin Oil.*" — "*On the Use of Glycerine in Gas Meters.*" — "*On the Manufacture of Black Paraffin Candles.*"—Kekulé "*On a Simple Method of Transforming Nitrobenzol into Aniline.*"—E. F. Richter "*On the Extraction of Fixed Oils by Bisulphide of Carbon.*" —G. C. Wittstein "*On the Use of Poisonous Colours on Wearing Apparel.*"—J. Oser "*On a Simple Method of Testing Flour.*"

No. 4, February.—A. Scheurer-Kestner "*On Rivière's Method of Manufacturing Caustic Baryta.*"—C. Scheibler: "*An Apparatus for ascertaining the Quantity of Carbonic Acid contained in the Gas used for removing the Lime from Beetroot Juice.*"—H. Schulz "*On the Chemical Composition and on some Physical Properties of different kinds of Animal Charcoal.*"—H. Vohl "*On the Use of Peat for Preparing Lighting and Lubricating Materials, and for Producing Acetic Acid, Wood Naphtha, Ammoniacal Salts, &c.*" —Baeyer "*On the Reduction of Aromatic Compounds by means of Zinc.*"

No. 5, March.—H. Wagner "*On the Extraction of Copper from Poor Ores in the Wet Way.*"—R. Wagner "*On the best Method of Preserving Sodium.*"—Dangevillé and Gautin "*On a Method of Discharging Aniline Colours.*"

No. 6, March.—A. von Waltenhofen "*On a new Electro-magnetic Machine, and on the Useful Effect and Cost of such Machines.*"—C. Puscher "*On a Method of Preparing Gelatine from Glue;*" "*On the Preparation of the new Mother-of-Pearl Paper;*" "*On Landscapes in Glass, a new Fancy Article;*" "*A Cement for attaching Brass to Glass.*"—R. Linner "*On the Use of Movable Tubs as Receptacles for Excrementitious Matters at Gratz.*"—W. Stein: "*A Method of ascertaining the Presence of Free Alkalies in Soap and Alkaline Salts.*"— C. Feldmann: "*A Bottle-brush made of Cane-strips.*"—T. Wimmel "*On the Adulteration of Japanese Wax.*"

Journal für praktische Chemie. March 7, 1867.

C. G. Lautsch "*On the Saturating Capacity of Periodic Acid.*"—F. W. Fernlunds *On the same subject.*—R. Hermann "*On the Composition of Rutile from the Ilmen Mountains.*"—E. von Sommaruga "*On the Equivalents of Cobalt and Nickel.*"—M. Delafontaine "*On the Oxides of Niobium.*"—P. T. Cleve and A. E. Nordenskjöld "*On the Hydrated Silicates of Iron.*"—C. Birnbaum "*On the Action of Sulphurous Acid on Hydrated Oxide of Platinum.*" —L. J. Ingelström: "*An Analysis of some new Swedish Minerals.*"

Le Technologiste. April, 1867.

T. Becker "*On the Method in Use at Stassfurt for Estimating Potash as a Tartrate.*"—C. Gišeke "*On the Detection of Free Sulphuric Acid in Sulphate of Alumina.*"—Coignet "*On a Solvent of Indigo and Cochineal.*"—L. Walkhoff "*On a Self-acting Apparatus for Drying Animal Charcoal.*"—Muth "*On a Method of Purifying Naphthaline.*"

NOTICES OF PATENTS.

2110. *Treating Fatty and Oily Matters.* G. Payne, Battersea. August 16, 1866.

An increased quantity of fatty acids is thus obtained. After the breaking up of any fat into its acid, and glycerine as its base, by sulphuric acid, as a further treatment the fatty acid is combined with an inorganic base (as litharge or potash), and then, by a stronger acid, the fatty acid is again liberated and may be distilled off.

2101. *Steel and Iron Manufacture.* J. Cameron, Mount Pleasant, Barrow-in-Furness. August 15, 1866.

The Bessemer process is modified by the use of lime, calcic, barytic, sodic, potassic, and ferric carbonates; with other iron ores, fluor spar and salt, as fluxes.

2083. *Production of Green Colouring Matter for Dyeing and Printing Textile Fabrics and Yarns.* J. A. Wanklyn, City, London, and A. Paraf, Manchester. August 14, 1866.—Not proceeded with.

Equal weights of rosaniline and an alcohol or suitable solvent are taken, with ethylic or isopropylic iodide (or other replacer of hydrogen), and are subjected to a temperature 230° Fahr. for three hours under pressure. The solution of sodic carbonate (one percentage strength) is added to the product in the proportion of four times its weight. There results a green dye in solution, and violet dye as a precipitate. This latter is converted by soda ley into a nearly colourless base, with violet salts. The base is powdered again, heated to 230° Fahr., and treated as before, more green solution resulting, and so on for two or three times until all is converted into the green dye.

2115. *Use and Application of an Inorganic Glyceric Ether.* A. Paraf, Manchester. Dated August 17, 1866.

Depends on the formation of a neutral arsenite which is of value in madder dyeing. Arsenious acid of commerce is dissolved in an equal weight of glycerine. This so-called arsenious glycerine ether, with residual arsenic dissolved in glycerine, easily decomposes in presence of steam, leaving the insoluble arsenious acid. 1 lb. of the ether mixed with 2 oz. of any crystallised aniline colour is dissolved in starch solution; steaming for about half an hour deposits the acid, and fixes the colouring matter in a printed textile fabric.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

133. W. Weldon, Park Villa, West Hill, Highgate, Middlesex, "Improvements in the manufacture of chlorine, and in the production of artificial oxides of manganese for employment both in that and other manufactures."—Petition recorded January 18, 1867.

284. J. Buhrer, Munich, Bavaria, and A. P. Price, Lincoln's Inn Fields, Middlesex, "Improvements in effecting the distillation of coal, shale, wood, peat, and other bituminous or carbonaceous substances."—February 1, 1867.

1122. J. Hargreaves, Appleton-within-Widnes, Lancashire, "Improvements in the manufacture of steel and soft iron from cast iron."—April 16, 1867.

1356. C. D. Abel, Southampton Buildings, Chancery Lane, "A new or improved method and apparatus for converting the gaseous products of combustion into combustible gases."—A communication from N. Lebedeff, St. Petersburg, Russia.—May 8, 1867.

1382. G. McKenzie, Glasgow, N. B., "Improvements in the manufacture of illuminating gas."—May 10, 1867.

Notices to Proceed.

39. B. Biggs, Laurence Pountney Hill, London, "Improvements in and applicable to candles."—Petition recorded January 7, 1867.

87. W. G. Blagden, Hackney Wick, Middlesex, "An improved method of separating silver from lead."—A communication from F. Marquez-Millan, Rue Liandier, Marseilles.—January 14, 1867.

119. E. Süvern, Halle, Prussia, "An improved mode of, and apparatus for, purifying the impure waters emanating from sugar factories and other industrial establishments, applicable also to the purification of sewage water."—January 17, 1867.

605. S. Newington, Ticehurst, Sussex, "An improved compound for destroying insects and preventing and checking blight in plants."—March 4, 1867.

CORRESPONDENCE.

Edible Earths.

To the Editor of the Chemical News.

Sir,—I notice in a recent number of your journal a paragraph containing the analysis of a species of clay eaten by the natives of Borneo, and where it is asserted that "no other analyses of any substances used as such have been made, or at least published."

Perhaps you will allow me to state that Vauquelin formerly analysed the clay eaten by the Ottomacs (Humboldt, "Ansichten der Natur"), and that an analysis by Dr. Trail of an earth used as an aliment is given in one of my works ("Utilisation of Minute Life"), where the results of another analysis by Liebig are also alluded to. Finally, I beg to subjoin my own analysis, made in 1865, of the earth which is extensively mixed with flour in Umea Lapmark in periods of scarcity:—

Water and organic matter	15·0
Silica	80·0
Sand	0·9
Alumina and oxide of iron	3·5
Carbonate of lime	0·6
	100·0

I am, &c. T. L. Phipson, Ph.D.

London, May 26.

Transparency of Red-hot Metals.

To the Editor of the Chemical News.

Sir,—In reference to the above subject, I may state that platinum, at least, appears to me transparent when it is at a strong white heat. If some carbonate of sodium is fused in a thin crucible, and then raised to a very high temperature, on shaking the crucible the motion of the fused salt may be discerned *through* the sides of the crucible. I am, &c. W. B. G.

Liverpool, June 3.

[This is more probably due to the fact that the platinum cools more rapidly where not in contact with the fused salt than it does where the salt touches it.—Ed. C. N.

To the Editor of the Chemical News.

Sir,—As to the transparency of some metals at bright red heat, workers in metals know it pretty well. Molten copper poured out of a ladle in a thick stream is as transparent as glass. I was acquainted many years ago, while at Utrecht University, with a gentleman residing there, who was the owner of an extensive establishment for rolling copper, &c.; the quantity of metal usually molten down at once exceeded ten tons in weight, and the workmen, among other tests about the proper degree of purity of the metal (*i. e.* freedom from suboxide), used to pour out 100 kilos. in a stream, the thickness of which was fully from 1 to 1·7 centimètre, and was as perfectly transparent as glass, with a slight bluish hue. Copper in bars heated for forging is the same; iron and platinum far more so; while gold 0·7 centimètre thick presents the same property; silver does not become transparent.

I am, &c. Dr. Adriani.

[We still think these alleged facts require verification by scientific men accustomed to exact observation.—Ed. *C. N.*]

Science and Art.

To the Editor of the Chemical News.

Sir,—Your correspondent "F.R.S." wants to know the Brompton meaning of the word "Science." A good many would like to know the exact sense in which "Art" is there used. "F.R.S." and the majority of the public appear to associate it only with painting, sculpture, &c. But from the mysterious addition of a final *s*, which has lately taken place (*e.g.* Albert Hall of Science and *Arts*), I suspect that the term is now intended to mean the useful and manufacturing arts. No one can deny that the word *Science* is properly associated with the *Art* of dyeing and calico-printing, the Society for the Encouragement of *Arts*, Manufactures, and Commerce, or the Dictionary of *Arts*, Manufactures, and Mines; but remove the final *s* in the last two instances, and the meaning becomes totally different.

Whatever may have been its original derivation and meaning, the word *Art* at present refers to two distinct functions. In one sense "Science and Art" is an incongruity, in the other sense it is a legitimate combination.

I am, &c. Puzzled.

Mnemonic Nomenclature.

To the Editor of the Chemical News.

Sir,—Permit me to rectify a statement made by a correspondent on page 200, No. 285 of the Chemical News. Gmelin did not publish any new plan for a chemical nomenclature in the year 1827. At that time Laurent was still at school, and Dumas had not yet made the discoveries on which the doctrine of substitution was based. However, in the next "generation" (1848) a chapter on that subject appeared for the first time in the fourth edition of Gmelin's "Handbook of Chemistry." In the English translation of that work, this chapter, entitled "Suggestions for a New Chemical Nomenclature, particularly for Organic Compounds," occupies just four pages (vol. vii. pp. 149—153). The article, by its allusions to recently discovered compounds and new chemical reactions, bears internal evidence that it was written immediately prior to its publication in 1848. Long anterior to this date I had conceived the idea which was the germ of my own scheme. In 1850 I extended the system of counting so as to express the highest combinations. My first promulgation can be proved by the following statements by well-known scientists:—

"On consulting my diary I find that the first time you mentioned your new chemical nomenclature to me, in which you proposed to use vowels as numerals, and to distinguish the non-metallic elements by different consonant terminals, was on Saturday, May 13, 1848. . . . .

This is no occasion on which to offer a criticism of your nomenclature, but I cannot refrain from adding my testimony to its wonderful adaptation to the simplest expression of the most complex chemical compounds.

"Charles A. Joy,
"Professor of Chemistry in Columbia College and in the School of Mines, New York."

"For several years preceding 1846 Professor S. D. Tillman and I resided in the same town. I well remember his plan, then and there made, of a new chemical nomenclature, in which the name of a compound denoted its exact component parts. The number of equivalents was expressed by a vowel immediately preceding the last letter (m) in the names of all metals, as well as before the different consonants expressing non-metallic elements. . . . .

"Edward Bayard, M.D.
"No. 6, West Fourteenth Street, New York."

The question of priority of conception will be deemed of minor importance by those who have carefully examined what has been done by Gmelin and by me. That Gmelin did not "fully elaborate" his scheme is evident from his own admissions. In the chapter alluded to (page 151, Watts's Translation, 1852) he says: "In working out the details of this nomenclature it would doubtless be found that many additions and corrections were necessary. . . . . In a nomenclature for organic compounds something more is required than the names of elements and the expression of their numbers by vowels." This author gave new names to all the elements, yet failed to express any but the simplest facts of combination. After devising a very defective numerical system, in which the value of vowels depended on their position, he was compelled to coin new words for each nucleus having no reference to their composition, thus virtually abandoning the vowel plan. By scrutinising Gmelin's method any one who comprehends the requirements of a complete nomenclature will be convinced that the scheme cannot be used as a substitute for the notation. Similar objections may be made to Mansfield's method (see "Theory of Salts," London, 1865). This author shows that the use of the five vowels as numerals was of English origin, and was employed, although not in connexion with chemistry, in Dr. R. Gray's "Memoria Technica" (new edition, Oxford, 1831).

I claim for my scheme, which is adapted to Gerhardt's unitary system, and may properly be called "the unitary nomenclature," as its chief merit, simplicity of construction. Accepting the old names of the elements, I have so modified them that each begins with its old symbol, and ends with its new; the latter so generally correspond with the former that only seven new characters are introduced. With these materials and a more perfect numerical method than that employed by Gmelin, I have succeeded in representing, by a combination of letters and syllables, bodies of the most intricate structure. For the first time, systematic terms have been applied to radicals, so-called residues, and their numerous combinations. Every hydrocarbon has an appropriate symbolic appellation, and not only polymers but isomers have distinctive names. The only paper which I have yet published on the subject contains word-formulæ for more than *seven thousand compounds*.

Although the unitary nomenclature is commensurate with all possible atomic combinations, I do not claim that the new names would be preferable to a portion of the corresponding names now employed, nor do I entertain the hope that any part of the new scheme will be adopted until combinations of terms on the old plan become too cumbersome for common use.

I am, &c. Samuel D. Tillman.

American Institute, New York, May 11, 1867.

Manufacture of Sulphuric Acid.

To the Editor of the Chemical News.

Sir,—In answer to the queries of "T. G. H., Lisbon," I beg to offer the following remarks:—

When pyrites is burnt, a considerably less quantity of sulphuric acid can be made with a given quantity of chamber space than when pure sulphur is employed, owing to the consumption of additional air in order to oxidise the iron, &c., in the pyrites; the nitrogen of the extra air thus employed occupies a portion of the chamber space, and thus renders the chamber relatively smaller. Also, to overcome the effect of the dilution of the gases, additional nitre must be employed. The quantity of sulphur which can be economically burnt with a given quantity of chamber space depends much on the mode adopted in working the chambers, on the size of condensing towers, &c., used. Usually there is a greater waste of sulphur when only one or two chambers are used than when several are worked together, arranged as "working" and "receiving" chambers. In Richardson and Watts's "Technological Dictionary," i. iii. p. 80, about 3000 cubic feet to 112 lbs. of sulphur per diem is given as an ordinary average quantity. This represents 1·672 cubic metre per kilogramme of sulphur per diem.

I am, however, acquainted with instances where a much larger proportion of sulphur has been regularly consumed than this. Thus, a single chamber, furnished with a coke condensing tower, burnt regularly 1 kilog. of sulphur (in the shape of pyrites, containing about 48 per cent. of sulphur) per diem to 1·047 cubic metre of chamber space; and at one time, when the manufacture was pushed to the utmost, only 0·726 cubic metres were allowed.

Several chambers worked together, on the English system, and furnished with good coke towers, averaged 1·080 cubic metre per kilog. of sulphur (as pyrites) per diem.

Allowing 1·200 cubic metre per kilogramme of pure sulphur per diem (representing about 2·1 kilos. of Huelva pyrites), a chamber of 29,000 cubic feet (English), or 821 cubic metres, should consume about 1437 kilogs. of Huelva pyrites daily. A kiln of the undermentioned dimensions will allow about 350 kilogs. of such pyrites per diem to be properly burnt. A larger quantity of pyrites may be passed through the kiln, but the burnt pyrites will frequently contain a considerable amount of unburnt sulphur. From 2 to 3 per cent. of sulphur is always left in the pyrites, so that four kilns of these dimensions would about suffice for the above chamber.

A convenient form of burner for Huelva pyrites is one measuring about 1·3 to 1·4 metre square at the level of the bottom of the charging door (*i.e.*, at the top of the mass of burning pyrites), and about 1·0 to 1·1 metre square at the level of the bars; between these levels a vertical distance of 0·6 to 0·7 metre is allowed. If deeper kilns be used, fluxing of the ore becomes a very probable occurrence. Larger or smaller kilns, with about the same relative areas, may be used.

A cast-iron pipe would, I think, be preferable to an earthenware one for conducting away the gases to the chamber, both on account of durability and the cooling of the gases. When pyrites is burnt, a thick sublimate is often formed in the pipe, materially diminishing its capacity. A tube of 0·5 metre internal diameter would suffice for the above kilns and chamber; but a larger one would be desirable, on account of this tendency to being blocked up.

A pipe of twenty-one metres length will hardly prevent fine dust of ferric oxide, &c., from being carried over into the chamber. For ordinary uses the presence of a little ferric sulphate, &c., in the acid produced is immaterial; but where concentrated acid is manufactured the presence of such bodies will often injuriously affect its sale. Arsenic is almost invariably present in acid made from pyrites. I am acquainted with an instance where the manufacture of sulphuric acid (rectified) from pyrites was given up, solely on account of the impossibility of selling the impure acid thus produced. It is, however, quite possible to obtain a colourless acid at 66° Baumé from Huelva pyrites.

Should "T. G. H." desire any further information, plans of burners, &c., I shall be happy to communicate with him.

I am, &c.

CHARLES R. WRIGHT, B.Sc.

St. Thomas's Hospital, Surrey, S., June 4.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Benzol and Phenol, Sulpho-derivatives of, (C=12).—A. Kekulé. Vogt's benzylmercaptan may be prepared by substituting sulphur for oxygen in phenol. Phosphoric sulphide and phenol are heated together in a retort, and the mixture distilled. The principal product of the reaction is thiophenol C_6H_5SH, identical with the benzylmercaptan of Vogt, obtained by the action of zinc and sulphuric acid on benzolsulphochloride. The other bodies formed are benzol, sulphide of benzol, and liquids of a high boiling point, probably phenylethers of sulpho-phosphoric acid. The sulphide of benzol thus obtained has been found identical with the sulphide obtained by Stenhouse from sodic benzolsulphate. The substance produced by oxidising sulphide of benzol, and called by this chemist sulphobenzolen, the author declares to be identical with sulphoxide of benzol.

Benzylmercaptan may be converted into sulphide of benzol by exposing one of its metal compounds to dry distillation. The decomposition takes place according to the following equation:—

$$2(C_6H_5SM) = (C_6H_5)_2S + M_2S.$$

Experiments in progress seem to show that thiophenol may be converted into benzol by losing its sulphur, or into phenol by exchanging it for oxygen.—(*Zeitschr. Chem.*, N.F., iii. 193.)

Thiacetic Acid from Acetic acid Phenol (C=12).—A. Kekulé. Phenol is still very generally believed to be in every respect analogous to the monatomic alcohols. It may now, however, be taken as certain that the so-called phenylic chloride, iodide, &c., are identical with the corresponding substitution compounds of benzol, and that the phenyl therein is incapable of being transferred to other compounds. According to the old view, acetic acid phenol acted upon by potassic sulphhydrate ought to give potassic acetate and thiophenol:—

$$\left.\begin{matrix}C_6H_5\\C_2H_3O\end{matrix}\right\}O + \left.\begin{matrix}K\\H\end{matrix}\right\}S = \left.\begin{matrix}C_6H_5\\H\end{matrix}\right\}S + \left.\begin{matrix}C_2H_3O\\K\end{matrix}\right\}O$$

The reaction, however, takes place in a different manner; phenol is formed and potassic thiacetate:—

$$\left.\begin{matrix}C_6H_5\\C_2H_3O\end{matrix}\right\}O + \left.\begin{matrix}K\\H\end{matrix}\right\}S = \left.\begin{matrix}C_6H_5\\H\end{matrix}\right\}O + \left.\begin{matrix}C_2H_3O\\K\end{matrix}\right\}S$$

Showing that it is not phenyl and the metal of the sulphhydrate which exchange their places, but hydrogen and acetyl, and that acetic acid phenol should not be viewed as phenylic acetate, but rather as acetylic phenylate.—(*Zeitschr. Chem.*, N.F., iii. 196.)

Phenol, Sulphoacids of (C=12).—A. Kekulé. The author considers the so-called phenylsulphuric acid to be a sulphoacid, containing a residue of sulphuric acid in a similar manner as nitro compounds contain a residue of nitric acid. He gives it the formula

$$C_6H_4\left\{\begin{matrix}OH\\S''O_2\\H\end{matrix}\right\}O$$

in place of the old one,

$$\left.\begin{matrix}C_6H_5\\S''O_2\end{matrix}\right\}O$$
$$H\}O.$$

The action of sulphuric acid on phenol, however, gives rise to the formation of two isomeric bodies—phenolpara-sulphuric acid and phenolmetasulphuric acid. The salts of the first being less soluble in water than those of the latter, their separation is easily accomplished by fractional crystallisation. If the phenolsulphuric acids still contain their original hydroxyl, as is assumed here, the hydrogen of the latter will be replaceable by an alcohol radical, without thereby causing a change in the general character of the sulphoacid. If methyl be introduced, sulphoacids will be formed, identical in composition with the acid obtained from anisol with sulphuric acid.

This substitution is effected by heating phenolpara- (or meta-) sulphuric acid with potassic hydrate, alcohol, and the iodide of the desired alcohol radical in sealed tubes.

The potassic salts of the phenolmeta- and phenolpara-sulphuric acid thus obtained resemble each other so closely that it is difficult to say to which of them the corresponding anisol compound belongs; but it is believed that there also exist two isomeric anisolsulphuric acids. The author also is of opinion that the action of sulphuric acid on aromatic compounds nearly always gives rise to substitution compounds.—(*Zeitschr. Chem.*, N. F., iii. 197.)

Monochlorphenyl (C=12).—Ed. Dubois has succeeded in obtaining monochlorphenol by passing a slow current of chlorine through cooled phenol. 500 grms. of phenol were taken, and the action of chlorine continued for twelve hours. On distillation, the portion going over between 212° and 225° C. was collected separately and rectified. He finds the compound thus prepared identical with the monochlorphenol obtained by the action of sulphurylchloride on phenol. Nitric acid converts it into dinitromonochlorphenol. Griess has obtained this body by treating phenol first with chlorine, and then, without previous purification of the chloro-compound, with nitric acid. The author believes he has observed differences between his compound and that of Griess, and it would, therefore, appear probable that in the latter chemist's case first di- or trichlorphenol was formed (vide *Ann. Chem. Pharm.* cxx. 286), which afterwards exchanged a portion of the chlorine against nitryl.—(*Zeitschr. Chem.*, N. F., iii. 205.)

Aluminic Sulphates, Basic (O = 8).—H. Debray. Zinc in contact with platinum (or lead) is readily acted upon by a hot solution of alum. A precipitate is formed of the composition of Lowigit:

$$KOSO_3 + 3(Al_2O_3,SO_3) + 9HO,$$

which is almost insoluble in strong chlorhydric or nitric acid, but attacked by sulphuric acid. Heated to low redness it loses nearly all its water; at a still higher temperature it decomposes into alumina and potassic sulphate. Finally powdered calcic carbonate digested in the cold with a solution of alum in excess forms a salt, readily soluble in dilute acids. Its composition is

$$4Al_2O_3,3SO_3 + 36HO$$

A solution of aluminic sulphate in excess, boiled with zinc or platinum, forms a precipitate soluble in dilute acids; dried at 100° C., its composition is $SAl_2O_3,3SO_3 + 20HO$. —(*Bull. Soc. Chem.* 7, 9.)

Nitrotoluol.—A. Kekulé, in a previous communication (*vide* Chemical News, No. 386), confirmed Jaworsky's statement, that the crystalline nitrotoluol is the pure compound, and the liquid not an isomeric modification of it, but simply a mixture of the pure with some other bodies. He now publishes some experiments he made with both the solid and the liquid nitrotoluol. If ordinary nitrotoluol is distilled, the greater portion goes over between 220° and 225° C.; the fraction distilling above 233° soon solidifies. The latter is purified by repeated distillation and crystallisation from alcohol or ether. The nitrotoluol thus prepared boils at 237° C., and crystallises readily. Nitric and sulphuric acid convert it into dinitrotoluol. On oxidation with potassic bichromate and sulphuric acid, paranitrobenzoic acid (nitrodracylic acid) is formed; the oxidation proceeds more readily than it does with ordinary nitrotoluol, and a better result is attained, both as regards quantity and quality. Toluol prepared from toluolsulphuric acid yields by careful treatment a nitro compound which after the first distillation solidifies to a great extent. From the facts—1st, that on liquid nitrotoluol being reduced with tin and chlorhydric acid, no hydrocarbon is observed to be given off with the vapours of water; 2ndly, that the toluidine prepared from liquid nitrotoluol contains aniline; and 3rdly, that a mixture of pure nitrotoluol and nitrobenzol on distillation behaves in a very similar manner to ordinary nitrotoluol—the author believes that the liquid state of ordinary nitrotoluol is due solely to an admixture of nitrobenzol. As to the source of this benzol in those cases where it was not originally present in the toluol, the author thinks it possible that under favourable conditions nitric acid acting on toluol (methylbenzol) might destroy the methyl, and, substituting nitryl, form nitrobenzol.—(*Zeitschr. Chem.*, N. F., iii, 225.)

MISCELLANEOUS.

Action of Charcoal in Removing Organic Matter from Water. — Mr. Edward Byrne has examined how far the statements generally made with regard to the action of charcoal in purifying water might be depended on. Nearly five pounds of new and freshly burned animal charcoal, of the degree of fineness used in sugar refineries, were packed in an ordinary stoneware filter. The water employed contained, in the gallon, organic matter, 10·80 grains; inorganic matter, 88·30 grains. The hardness, before boiling, was found to be 50·50°, and after, 33°; and the oxygen required to oxidise the organic matter contained in one gallon amounted to 0·0116 grain. Several gallons of the water were allowed to percolate slowly through this charcoal, and, upon examination afterwards, it was found that, of the *inorganic matter*, 52·60 grains were removed from the first gallon, but from each succeeding gallon less and less, so that, from the twelfth gallon that passed through the charcoal, only 8·80 grains of inorganic matter were removed. Of the *organic matter*, 4·80 grains were removed from the first gallon; but, with a gradual decrease, the charcoal ceased to remove any after the sixth gallon. In fact, immediately afterwards, it commenced to give back a portion of the organic matter removed in the first instance, the quantity returned to the twelfth gallon amounting to 1·55 grain. Thus, of the 13·54 grains of organic matter removed by the charcoal from the first six gallons of water, as much as 4·98 grains were given back to the next six gallons, from which the author concluded that, had this set of experiments been carried a little further, all the organic matter removed at first by the charcoal would have been given back again. The author, in conclusion, gave it as his opinion that, by chemical agency, bad water could be purified to a very limited extent only. [Mr. Byrne has overlooked the important fact that the efficacy of charcoal as a filtering agent for the removal of organic matter does not depend upon mechanical absorption, but upon oxidation; and from his drawing no distinction between the removal, by charcoal, of the inorganic and the organic impurities of the water, it would seem as if he were ignorant of this property. A few ounces of charcoal, used properly, will oxidise a pound or more of organic matter. Charcoal has not fair play in a filter unless it is occasionally allowed an opportunity of absorbing atmospheric oxygen.—Ed. C. N.]

Composition and Quality of the Metropolitan Waters in May, 1867.—The following are the Returns of the Metropolitan Association of Medical Officers of Health:—

Names of Water Companies.	Total solid matter per gallon.	Loss by ignition.*	Oxidisable organic matter.†	Hardness.	
				Before boiling.	After boiling.
Thames Water Companies.	Grains.	Grns.	Grains.	Degs.	Degs.
Grand Junction	21·17	1·00	0·68	12·0	4·5
West Middlesex	19·00	0·45	0·40	11·5	3·5
Southwark & Vauxhall	18·43	0·50	0·46	12·0	4·0
Chelsea	20·83	0·75	0·69	12·0	4·0
Lambeth	20·77	0·50	0·64	12·0	4·0
Other Companies.					
Kent	26·62	0·20	0·18	15·0	8·0
New River	16·80	0·50	0·21	11·0	4·0
East London	18·74	0·51	0·39	11·0	4·0

* The loss by ignition represents a variety of volatile matters, as well as organic matter, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

† The oxidisable organic matter is determined by a standard solution of permanganate of potash, the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

Hy. Letheby, M.B.

Death of Pelouze.—We have to announce the death of one of the best and most celebrated French chemists, M. Pelouze, Master of the Mint in Paris, which took place on the 31st ult. The previous day he had been attacked by heart dropsy, and he expressed an urgent desire once more to breathe the pure air of the heights of Bellevue (near Meudon). No sooner was he in the carriage than a faintness came over him, from which he recovered with much difficulty. His family yielded to his wish by taking him to the desired spot, where he arrived in the evening only to die on the following morning at 7. Since the sudden death of his excellent and distinguished wife he pined away, notwithstanding the affectionate attentions paid him by his son and three daughters. He was born at Valonges in the department of the Manche in 1807, and was, at his first outset of life, a simple laboratory student. He became successively Professor at the Polytechnic School, Professor at the French College, Member of the Academy of Sciences, Verifier of the Mint Assays, Member of the Municipal Council of Paris, Director of the St. Gobain Glass Works, and, lastly, President of the Commission of the Mint, the highest post that a practical chemist can aspire to. M. Pelouze died with resignation, and in the faith of a Christian. He was buried at Montmartre Cemetery, in the family tomb, the corpse being followed by an immense *cortège*, composed of all the *élite* of society, the principal members of the Academy, six carriages of the Municipal Council, and the National Guard in full uniform. M. Fremy, the distinguished chemist of the *Conservatoire des Arts et Métiers*, delivered the usual funeral oration.

Action of Light on Chloroform.—The chloroform used for the experiments had a specific gravity of 1·492 at 70° F., was absolutely free from acid reaction, and imparted no coloration whatever to sulphuric acid. The diluted chloroform was made of eight ounces of the former, by the addition of one fluidrachm of strong alcohol. The bottles used for the occasion were made of flint glass, of uniform size and shape, and filled alike. The experiments lasted one week during the hot days in August. It was concluded from these experiments:—1. That in order to preserve pure chloroform of specific gravity 1·49, it should be kept totally excluded from the light. 2. That to keep chloroform in the daylight, it should be reduced in specific gravity by the addition of about two fluidrachms of 95 per cent. alcohol to one avoirdupois pound of chloroform, sp. gr. 1·492. During the repetition of some of these experiments, attention was drawn to the presence of moisture in some of the bottles, and it was determined to try its effects on chloroform; accordingly, chloroform of 1·492, dried by standing over chloride of calcium, was kept in absolutely dry bottles, and in bottles slightly moist, and both kinds exposed to diffused daylight and direct sunlight. The bottle containing the moisture always showed the presence of free chlorine much sooner than the dry one, though the entire absence of moisture would not be sufficient to preserve the chloroform unaltered. But, if the chloroform had been reduced in specific gravity to 1·475 or less, the presence of several drops of water in the bottle would not induce the liberation of chlorine after an exposure of two weeks to the direct sunlight. For medicinal purposes—that is, for inhalation—this amount of alcohol would be unobjectionable, since it amounts in one fluidounce only to about forty drops.—*J. M. Maisch, Proc. Am. Pharm. Assoc.*

NOTES AND QUERIES.

Caseine.—Sir,—I wish to know in what form caseine is sold in Manchester, of whom it can be procured in quantity there or elsewhere, and at what price?—J. E.

Carbon Biscuits.—Sir,—Can any of your readers kindly supply me with a recipe for making "carbon biscuits;" also where they are to be procured?—Sheff.

Dyeing Fancy Leather.—Sir,—I should be glad if you could inform me where I can purchase a work on dyeing and dressing fancy leathers, &c., and similar articles.—E. Church.

Repairing Looking-glass.—Sir,—I have a large looking-glass, with a patch of silvering about as large as a shilling rubbed off in the centre. Can I mend it? I am acquainted with the mode of making looking-glasses, and should think that with plenty of mercury and a piece of tinfoil somewhat larger than the bare spot, there would be no difficulty. Before I begin, I should, however, like to know what the experience of others may have been.—J. Thompson.

Santonine.—Sir,—In answer to your correspondent, I can recommend chloroform as a solvent for santonine for preparing good microscopic slides. Dissolve santonine in six or eight times its weight of chloroform, and allow a drop to fall on a glass slide and evaporate spontaneously. Beautiful rosettes of crystals will be left. They can be mounted with Canada balsam, or may be viewed dry.—F. R. W.

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. 6d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

A. Parkes.—Too late for insertion this week.

Ferrum.—Add a little caustic soda to the water, and you will find that the iron axles and shaft will not rust so readily.

Jehu.—Apply to Professor Tuson, at the Veterinary College, Camden Town. We cannot answer such questions.

S. K. Rawfolds.—Miller's "Chemistry," Bloxam's "Chemistry," Watts's "Dictionary of Chemistry," Fresenius' "Qualitative and Quantitative Analysis," and Sutton's "Volumetric Analysis," will form a good foundation for the chemical library of your Mechanics' Institute.

J. T. Gordon.—The name and address of the inventor of the ice-making machine are given in the article describing the machine. See page 29 of this volume, No. 372.

Fire-damp Indicator.—A few weeks ago the *Scientific American* advised a correspondent, who had applied for Mr. Ansell's address, to forward the letter to the "care of W. Crookes, England." Our American contemporary will be glad to know that the advice was taken, and was perfectly successful. The letter has been forwarded to Mr. Ansell.

Glycerin Soap.—We have received from the manager of Price's Patent Candle Company samples of a new preparation of toilet soap. It contains half its weight of pure distilled glycerin, and is apparently free from cocoanut oil or excess of alkali. The glycerin is solidified by dissolving in it an equal weight of fine toilet soap. This article, from its containing so large a proportion of glycerin, if exposed to the air, attracts moisture and becomes sticky. It has been found to lather and wear well, and has a fragrant perfume. The value of glycerin as a remedy for chapped or irritated skins is now well known.

Iron Eggs.—A correspondent draws our attention to the following statement in an American paper, and asks if any one can throw light upon the subject:—"Eggs with iron shells will be a fact at the Paris Exposition. A Berlin chemist caused his hens to produce them by feeding them on a preparation in which iron was made to take the place of lime." We should be sorry to throw doubts on the authenticity of the statement, but we pity the poor chickens! Probably, however, they were *cannards*, not hens, which were experimented on. Would the iron eggs be thick enough to be used against armour plating? Boiled hard, they would serve as solid shot, and, if sucked and filled with powder, they would make capital shells, as effective against our iron-clads as any other foreign-made shells would probably be.

Errata.—Dr. Miller has called our attention to two misprints in our report of his first lecture. Page 260, twenty-two lines from bottom, *for* "magnesium," *read* "magnesia;" page 262, seventeen lines from bottom, *for* "light," *read* "eye."

Communications have been received from G. Foord; P. Jessop; Dr. Price (with enclosure); W. Valentin; C. R. C. Tichborne; S. T. Tillman; Professor Jay; J. W. Swindells; G. Burdtch; Johnson and Matthey; H. R. Marsden; Dr. W. T. Robertson; J. Bedford; R. H. Wilkinson; G. F. Rodwell; E. C. C. Stanford; Dr. W. Allen Miller; E. Church; Rev. J. L. Gordon; L. Mond; W. White; E. P. H. Vaughan; S. Hunt; S. Muspratt; H. L. Rayner; H. K. Bamber, F.C.S.; Geological Society; H. Sugg; C. R. Wright; R. Oxland; Mr. McDonnell; James Blackbourne; Gossage and Sons; A. E. Hawkes (with enclosure); W. Smith; Dr. H. Letheby; Charles Cochrane (with parcel); Henry Deane (with enclosure); John Wilkinson (with enclosure); J. Atkinson; Chas. U. Wright (with enclosure); Alex. Parkes (with enclosure); Dr. Odling.

Books Received.—"New Theories of the Universe," by James Bedford, Ph.D.; "The Technologist," June; "Transactions of the American Institute for 1865-6;" "Photographs of Eminent Medical Men," by W. T. Robertson, M.D., &c.; "Natural Philosophy," by C. Brooke, M.A., F.R.S., &c.

THE CHEMISTRY OF THE FUTURE.

The meeting of the Chemical Society on Thursday, the 6th inst., will always be memorable in the history of the Society. The importance of the subject which Sir Benjamin Brodie was to bring forward, the fact that eminent physicists and mathematicians had been specially invited to attend, and the probability that the discussion would vie in interest with the lecture itself, justified us in taking unusual means to secure a full and accurate report of the proceedings. We are sure we need make no apology for devoting to this abstruse subject so large a space of our present issue. The report of the lecture, and the discussion thereon, we are justified in speaking of with pride as a veritable *tour de force* of the shorthand writer. Having to deal with a multitude of technical expressions, enhancing the difficulties of his wonderful art, he has given to our readers the very words as they fell from the lips of the speakers; the editorial right of omission or condensation having been very sparingly exercised.

In order to give unabridged and undivided this remarkable report, occupying almost the entire space of an ordinary number, we have been compelled to omit several original articles, and nearly the whole of our foreign and home correspondence; but so that we should not disappoint that numerous class among our readers, who care less for ideal than for positive chemistry, and who value the Chemical News in proportion as it gives them solid facts and useful hints, we have enlarged this number to twenty pages by the issue of a supplement.

Whilst referring to our printing arrangements, we would wish to seize the occasion of stating that with the commencement of the next volume, the first number of which will appear on July 5, several improvements in the mechanical department of the journal will be introduced. Entirely new type has been cast specially for us. The kind selected is of the peculiar, legible, old-fashioned, eye-satisfying character now coming so much into vogue. Moreover, it will harmonise with the old-fashioned figures which we have hitherto adopted. In order to secure uniformity throughout, our type-founders have undertaken to cut special matrices for the barred letters and other chemical symbols which are not met with in the ordinary founts.

For a considerable time we have been embarrassed with the abundance and richness of our materials, and have been reluctantly constrained to postpone the insertion of many articles from some of the most eminent chemists. For the future we trust to do more justice to them.

Pending arrangements for the enlargement of the Chemical News, we shall now and then trench upon our advertisement pages for the publication of such matters of secondary interest as our subscribers will not care to bind up in a permanent form. Some articles and paragraphs will be set in smaller type, without, however, any sacrifice of legibility, since the new type will be much clearer than that now in use. Studious eyes, too, will appreciate the comfort of the fine toned paper on which for the future the Chemical News will be printed. Several minor improvements will be observed, which need not now be specified.

For the future the printing and publishing offices will be in close proximity, which arrangement, among other advantages, will enable us to give the chemical and scientific news down to the moment of going to press, and materially conduce to our editorial efficiency.

CHEMICAL SOCIETY.

Thursday, June 6, 1867.

Dr. A. W. Williamson, F.R.S., *Vice-President, in the Chair.*

The minutes of the previous meeting were read and confirmed.

Sir Benjamin C. Brodie, Bart., Professor of Chemistry in the University of Oxford, then delivered the following lecture:—

"*On the Mode of Representation afforded by the Chemical Calculus, as contrasted with the Atomic Theory.*"

Mr. President,—I feel that I have undertaken this evening a truly difficult task, which is to give to the Chemical Society, in the brief space of one hour, an account of a somewhat abstruse and difficult subject, the exact comprehension of which requires that it should be minutely considered in all its details. I should not, however, shrink from this, if I did not feel that the subject is really before those, who are most competent to judge of it, in a somewhat imperfect form; that I have as yet offered to the chemical world the first part only of the method of which I am about to speak; and that this method will be much better comprehended, both from a mathematical and chemical point of view, when you have before you the subsequent parts which I hope to present hereafter.

I am to speak of a method of representing the facts of chemistry, which is fundamentally different from the method at present in use. Let me say a few words upon the past history of chemical theories.

I believe that theory is essential to the existence of chemistry. The birth of the science was inaugurated by the construction of a definite theory of chemistry—the first theory which had ever been proposed, and which sought to give a definite and rational account of the facts of the science. This theory was the once world-famous doctrine of Phlogiston. In this theory the facts of chemistry were explained by the agency of a subtle, hypothetical, all-pervading principle, by the transference of which, from one chemical substance to another, it was assumed the facts of chemistry were correctly accounted for. It is easy, from our present point of view, to pass critical remarks upon the doctrine of Phlogiston, but it is not quite so easy really to comprehend that doctrine, and to put ourselves in the position of those great chemists who worked and who studied through its agency. If ever anyone was tempted to speak slightingly of the doctrine of Phlogiston, let him remember that through the instrumentality of this doctrine the great discoverer of chlorine, the chemist Scheele, worked. Let him remember that the exact mind of Cavendish was contented with this doctrine. Let him remember again that the illustrious Priestley, that transcendentally inventive genius, in posses-

sion of this doctrine, made the great discovery of oxygen; and that not only was he then content with this doctrine, but that he died a firm believer in and adherent to it. However, the doctrine of Phlogiston, like many human things, was destined to pass away,—Lavoisier shattered Phlogiston. For no inconsiderable period after this, chemists appear to have worked, if I may so say, without a theory; that is to say, that, as during the long alchemical ages chemists were occupied in collecting together those facts which were afterwards to be embodied in the theory of Phlogiston; so for a period of above thirty or forty years—that is to say, from the time of Lavoisier to the time of Dalton—chemists were employed in collecting together that exacter system of facts which was to form the basis of a far wider, a far more comprehensive, and a far nobler theory, namely, the great atomic doctrine. However, Davy appears to have worked and to have made his great discoveries without a theory. Davy never admitted the atomic theory, but rested content simply with the facts of numerical analysis.

In the year 1808 there appeared that famous book, "A New System of Chemical Philosophy," which contained the germs—indeed, I may say, almost the full development—of the atomic theory itself. In this atomic doctrine Dalton took up the conception of combination, which was introduced into the science by means of the theory of Phlogiston. He took up that doctrine of combination, and moulded it into a new and a more definite form. It would be useless for me, before the Chemical Society, to dwell upon the atomic theory. It is a theory with which every one is familiar, for every chemist of this day has worked with that theory, has conceived his science from the point of view of that theory; and, indeed, I believe it is, in the opinion of many, almost impossible that that doctrine should ever fall to the ground. This doctrine of Dalton, however, was a doctrine far more audacious than that of Stahl. In the theory of Phlogiston, Stahl considered that he had palpable evidence of the transference of his Phlogiston from chemical system to chemical system; but Dalton told us that this notion of the continuity of matter—that obvious fact which our senses teach us—was simply an illusion of the senses, and that, if only we could see things aright, we should see that this world, which appears to us so connected and so continuous, was really made up of an almost infinite number of disjointed fragments.

From the point of view of the atomic theory, I say, chemists have worked for a period now of about sixty years, and the progress of chemical theory has consisted in the almost constant and unremitting development of this doctrine. I cannot say, however, that this has been an unremitting progress. It has rather been a succession of events. System has followed system, doctrine has followed doctrine; but these doctrines have, one after another, fallen to the ground. We have had but little that is permanent, and at the present moment the theory of chemistry is built upon the ruin of other theories. Now, no one can have more respect, or more admiration for these great ideas, which were thus ushered into the science by Dalton, than I myself have. It cannot be necessary for me to express to this Society the admiration which I feel for that theory; but, nevertheless, I cannot but say that I think the atomic doctrine has proved itself inadequate to deal with the complicated system of chemical facts, which has been brought to light by the efforts of modern chemists. I do not think that the atomic theory has succeeded in constructing an adequate, a worthy, or even a useful representation of those facts. I say that for sixty years the united efforts of chemists, including many of the most able men in the world, have been devoted to the development of this doctrine, and they have formed their representations upon this doctrine. Now, let me read to you an account of the last modern representation of the atomic doctrine, and the chemical symbols in which the atomic doctrine has resulted. I will read to you a paragraph headed "Glyptic Formulæ;" it is given in a scientific journal. Here is the paragraph:—

"Those teachers who think, with Dr. Frankland and Dr. Crum Brown, that the fundamental facts of chemical combination may be advantageously symbolized by balls and wires, and those practical students who require tangible demonstration of such facts, will learn with pleasure that a set of models for the construction of glyptic formulæ may now be obtained for a comparatively small sum." (Much laughter.) "At first sight, the collection of bright-coloured and silvered balls suggests anything but abstract chemical truth,"——

And so on. However, I will tell you what you may get for your money:—

"There are seventy balls in all for the representation of atoms—monads, dyads, triads, tetrads, pentads, and hexads, being distinguished by the number of holes pierced in the balls. To connect these into rational formulæ"—[which, I confess I should think was a truly difficult problem]—"brass rods, straight or bent, and occasionally flexible bands are employed." (Laughter.)

And so on. However, the editor seems to have had some misgivings, for he proceeds to say,—

"Whether they are calculated to induce erroneous conceptions is a question about which much might be said."

Now, however much might be said upon this subject, I certainly am not going to say a great deal to the Society upon it; but it is truly a remarkable fact, that the atomic theory, after so many efforts, has resulted in such a symbolical representation as this. I think that great injustice is done in connecting the names of Dr. Frankland or of Dr. Crum Brown specially with such ideas as these, for I cannot but say that I think the promulgation of such ideas—even the partial reception of such views—indicates that the science must have got, somehow or another, upon a wrong track; that the science of chemistry must have got, in its modes of representation, altogether off the rules of philosophy, for it really could only be a long series of errors and of misconceptions which could have landed us in such a bathos as this.

You may, however, ask me, and with reason, "In what way, then, are we to represent the facts of chemistry, if we are not to represent them in this way? Do you mean to deal with this complicated system of facts, and to offer us no mode of representing these facts, and no mode of conceiving these facts?" Now, I certainly believe that any person who seriously attacks these ideas, is bound to show some other, and, I will say, some better way of representing the facts. I think he is bound to do this, or he should refrain from his attacks. You ask me, how we are to represent the facts of the science. It is to that question that I wish to offer an answer to-night.

I say that we are to express the numerical facts of the science by means of symbols; but I attach to the term "symbol" a very special signification. We have plenty of what are called "chemical symbols" already; but these chemical symbols are not, from my point of view, symbols at all, and you will presently see why. Not only according to my ideas, but according to the ideas of most persons who consider this question, a symbol may be regarded as a mark by which we express the objects of our thoughts for the purpose of reasoning about those objects; and one which is capable of being combined with other similar marks according to certain definite laws of combination; which laws of combination are to be possible, through the interpretation of the symbol, in the subject matter which is symbolized. That is what I mean by a symbol.

You will readily see that our present notation really can hardly be called, even in courtesy, a symbolic representation. The reason is, in the first place, that these letters

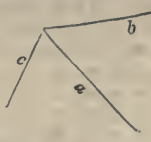
are not capable of being combined with other letters, or other marks, according to any definite laws at all; and, in the second place, so far are they from having any definite signification or meaning attached to them, that every chemist thinks himself at liberty to deal with them just as he pleases, according to his fancy. Now, I say, I wish to put a restriction upon that mode of dealing with the subject, and to bring my fellow chemists and myself under some definite laws when they deal with symbols.

Symbols are of two kinds. We may have symbols of things, and we may have symbols of operations. Symbols of operations are simply symbols of what we do to things. Take a popular case; ordinary language is an imperfect symbolic system, and here we have just these two kinds of symbols. A "dog" is the symbol of a thing, and "beating," "caning," "coaxing," and so on, are the symbols of operations, or of something which we may do to a dog. We have marks by which we express things, and marks by which we may express what we do to things. We might also have a third kind of symbol; we might have the symbol of an operation and a thing together. Thus, if we did not wish to represent particularly what sort of animal we were going to beat, we might have a single mark for "beating an animal;" the thing and the operation being included in one.

I purpose, however, to go into a more exact kind of symbolism; but before I commence my explanations, I should like to remove one or two popular errors upon this subject. I believe there is no error more ingrained in the popular mind than that these marks $+ \; - \; \times \; =$ are the symbols of adding, subtracting, multiplying, and identification or equalization; I mean that these marks are purely arithmetical symbols, and are to be used for the purposes of arithmetic alone, and that in any other subject matter to which they are applied it is essential for us to give these symbols their arithmetical signification. If that were true, the application of symbols to the science of chemistry would simply be, from my point of view, an impossibility.

Perhaps I shall best illustrate this matter, if I give you from another subject, an example of the mode of constructing a symbol, and what we mean by a symbol. It is an example which will bring before you clearly how independent symbols are of their arithmetical meaning or interpretation. I say of their arithmetical *meaning*, not of their arithmetical *laws*, which is another thing. In ordinary algebra we denote, by the mark a, the operation of conferring upon the unit of length a certain length which we designate as a. This length we may call three feet, and the mark a will thus stand for a line three feet long. Now, if we take another symbol, b, that may indicate to us a line drawn in the same direction as a, but of another length. We will say that b is five feet. Now a tells us that we are to draw a line of a certain length; and we may say that the symbol $+ a$ means that we are to draw it in a certain direction. Now if we ask what is the meaning of $+ a + b$, this indicates to us that, having drawn a, we are to start again, and we are to draw another straight line of the length of five feet, which we call b. Or, in ordinary geometry, $+ a + b$ would symbolize to us a line, the length of which was the sum of the length of a and b, and drawn in the same direction.

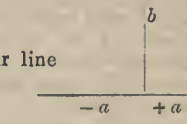
I wish now to bring before you, very briefly, an illustration of how totally unnecessary this arithmetical application of the meaning of the symbol $+$, is to its algebraic meaning. We have another kind of geometry, we may say, in which the symbols a, b, c, and so on, may indicate to us not only length, but direction also; so that if we take a certain point as our starting point, the symbol $+ a$ would indicate to us that we were to start from the point a and draw the line $+$ in a certain direction,—we will say towards the horizon. And b would indicate to us that we were to draw a line in another direction, and of another length; and c that we were to draw a line in a third direction, and also of another length. Thus



in short, it is open to us, if we choose to do so, to express by letters, not magnitude only, but also position.

Now, I wish you simply to see at what we arrive by following out these principles. What is the interpretation of $a + b$? a tells me to draw a line from our starting point in a certain direction and to a certain length. $a + a$ indicates that I am to make a line in the same direction as a and twice as long; in like manner $-$ would also indicate to us the direction in which we were to draw our line relatively to the starting point. $- a$ would be a line equal in length to a, but in the opposite direction to $+ a$.

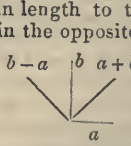
Now b tells us that we are to perform upon the unit of length an operation which is to consist in drawing a line in another direction. Here is our line



What therefore do we mean by $+ a + b$? Why $+ a$ tells us that we are to construct the line a. And having done that we are to go on again and construct b. That is done by beginning again at the end of the line a, and drawing a line in the direction of b, and equal in length to it, by which means we get

If we draw the diagonal of the parallelogram of which a and b are the sides, the diagonal of that parallelogram is expressed, and properly expressed, as $a + b$

And I say that a line drawn through the first point, equal in length to the other diagonal of the parallelogram but in the opposite direction, is properly represented by $b - a$



Those two diagonal lines in the system of geometry express $a + b$ and $b - a$. The reason of this you will perceive is very obvious, for, as we all know, the diagonal line, relatively to direction and to the motion which makes it, would be the same in kind and in quantity as the motion which constitutes the lines a and b. In short, we first of all construct the line a, and then we go on again and take up the line b. The diagonal of the parallelogram is therefore properly expressed as $a + b$, but of course this diagonal is not equal in length to the sides of the parallelogram.

There is one other property I must refer to, which is very important, and comes out to us in the symbol $+$. It is, that $a + b$ is the same thing as $b + a$. Why is this? It is simply that when we go along the line in direction a, and then travel through the length of b, we arrive at the same quantity as when we go along the lines $b + a$.

In constructing any calculus or method, then, the principle to be observed, in regard to the symbols, is by no means to give to them their arithmetical meaning or interpretation, but simply to construct them properly according to the laws which they obey in arithmetic and in algebra.

To take another example, using the marks + and − as the simplest illustration. They may be regarded as marks which are subject to a certain system of laws, which laws are given in the following equations:—

$$+ + = +$$
$$+ - = -$$
$$- + = -$$
$$- - = +$$

If, then, you can find in any subject matter, any properties to which you may apply these symbols + and − consistently with this interpretation, I think you are justified in using the symbols + and − to express those properties.

Let me proceed to explain, very briefly, what I mean by a chemical symbol. The object, I should say, of the first part of this method is to discover a proper system by which we are to express the unit of chemical substances. I may put this in another way, and say that we wish to discover what is the nature and the number of the operations by which chemical substances are made or constructed. That is the first object of our method. I should, perhaps, limit myself a little farther, for I should say that before we begin to think about chemical substances at all we should conceive of them as all brought into the condition of perfect gases. Now, the reason of this is one which I am sure will commend itself to every chemist: it is the simplicity of the laws to which gaseous combinations are subject, which simplicity was first discovered by the great chemist Gay-Lussac. Of course we may deal with the properties of the combinations of solids and liquids, but here it is far more difficult for us to arrive at any intelligible and simple results; and, whether rightly or wrongly, before beginning to think about the nature of a chemical substance, I, for my part, always conceive it as brought into the condition of a gas. And to go a little further, and to speak a little more definitely, we shall always consider the chemical substance brought into the condition of a gas, at the temperature of 0 degrees, and at a pressure of 760 millimetres. This is the sort of ideal chemical world with which we have to deal. It is a world of gases.

First let me indicate to you the definition which I will take of a unit of matter; for it is absolutely essential, before we think about matter at all, to begin with defining the unit which we are about to consider. That definition is of such great importance that I have had the words placed up before you in this diagram.

The unit of ponderable matter, is that portion of ponderable matter, which, at a temperature of 0 degrees, and at a pressure of 760 millimetres of mercury, occupies a space of 1000 cubic centimetres.

From considering the unit of matter, I pass now to the consideration of a unit of another kind, and that is what I call the unit of space—that is, the volume of 1000 cubic centimetres. And just as, before we begin to think about chemical substances, we must bring them all theoretically to the state of gas; so, before beginning to think about the unit of chemical substances, we must begin by thinking about a unit of space. This is the fundamental conception of this method; and it is a notion which appears to me to be almost essential to any constructive chemistry at all—that is, the conception of the unit of space; let us, therefore, clearly understand what the unit of space means. Now, that there may be no doubt about it, I have brought you the unit of space [exhibiting a hollow cube with glass walls, and of the dimensions above assigned to the unit of space].

You have to do something else, however, before you get the unit of space. It is indeed the space of 1000 cubic centimetres which is confined within these glass walls; but before you can get at the unit of space, you have to go a step farther, and by the process of imagination, or by the efforts of reason, you have to divest this cube of glass of weight, and take out of it all the ponderable matter which it contains, and conceive the space within the walls divested of matter altogether. Now, this unit of space is so fundamentally important to us that I shall begin by giving it a mark to itself. The mark which I give to that unit of space is, for certain good reasons which I will not explain now, the mark 1. When you see that mark, it is to recal to your mind the matter contained in the unit of space. Now, what is that matter? Why, that matter is simply no matter at all; there is no ponderable matter in it.

Perhaps, however, if I were to speak a little more exactly and precisely, I should say, for the benefit of those persons who may be more philosophically inclined, that the mark 1 is the symbol of the operation of taking the unit of space as it is. That is, take the unit of space as it is, and do nothing at all with it.

However, we must not only consider units of space, the consideration of which alone would lead us to very little, but we are going to consider the units of matter. Now, how are we to conceive a space becoming matter, or of matter getting into space—chemically, I mean? Well, I shall think of this through the aid of an operation, and I shall define by a mark the operation by which this empty unit of space is turned into a unit of ponderable matter. For example, I will take x as such a mark. This is the mark of the operation by which the unit of space becomes a unit of ponderable matter. It is the mark of a certain density which is appropriated to x, and of a certain kind which is also supposed by x. Here, then, is x, the symbol of the operation; and how are we to symbolize the performing this operation upon the unit of space? I shall do this in a natural manner by writing the letter x before the unit of space, $x1$; and that indicates to me matter of a certain density, and at 760 millimetres pressure.

How are we now to conceive of matter, double the density, but the same in kind as x? Having once conferred upon the unit of space this density, we have only to perform the operation a second time. Hence, to double the density, we have only to write x again, thus: $xx1$. This will symbolize that we confer on the unit of space a certain density, and having done that we confer that density on it again. That is, we make it double the density. $xxx1$ will mean that we give it three times the density. We can abbreviate the expressions. We need not write the x's out at length. The unit of space is 1; with the first density conferred upon it, it becomes $x1$; with double the density, $x^2 1$; and with three times the density, $x^3 1$. If you compare these operations with the symbols which express the densities, you will see that the symbols of the units of matter which we have thus constructed, stand to the numbers which express the densities of that matter, in the same relation as numbers do generally.

We will now take another kind of matter: 1, $y1$, $y^2 1$, $y^3 1$. This, again, would be a symbolized ponderable matter which would be contained in this glass box at the pressure and temperature indicated, of the kind indicated by y, and of the density indicated by the number of units of y. You will see this more obviously when we come to speak of the symbols of chemical substances.

If we proceed farther upon the same principles, we come to consider what is the symbol of units of space containing two kinds of matter. Well, on the same principles, you see, we have $xy1$ as the symbol of the unit of space filled with the matter of x, and also filled with the matter of y; that is to say, having the density xy, the sum of the densities of x and y. And of course we can, in this way, symbolize also the unit of space filled with the matters x and y in various proportions.

You will see that there is a real analogy between the symbols which I am here employing, and the symbols which I used just now in my illustration derived from double agebra; for just as the symbols of double

algebra indicate to us not only the length of a line, but also its direction or position, so these chemical symbols indicate to us not only the weight, but also the kind of matter. You are not to confound them with the numbers which express the densities, or the letters by which we might express those numbers; but they are, I say, symbols which express to us, at one and the same time, the nature of the matter and the density of the matter, having a double signification of this kind.

Before we go further, let me say a word about the nature of this operation. I am here symbolizing the unit of matter by the symbols of the operation by which the unit of matter is made. But what is that operation?

Well, speaking generally, I may say, without entering into too nice logical distinctions, that it is an operation which every chemist knows better than any other physical operation. It is the operation of combination. That is what x is, and what y is. They are operations of combination. We are getting thus at a definition of our unit in terms perhaps more in accordance with our ordinary language. We will call the matter of x, A, and the matter of y, B; and the matter of the unit of space, merely o. That is always definite. What, then, does x stand for, considered from the point of view of combination? It is the operation of combining the matter A with any substance which we please to write after the symbol of the letter. Similarly, y is the symbol of combining the matter B. Then we may call 1 the symbol of no matter; it is the symbol of the unit of space, which has no matter. $x1$ tells us we are to take A, and combine it with the matter of the unit of space. The result of that is to constitute the matter A. Having done that, I write y to it ($xy1$). That tells me to take the matter B and combine that also with the matter of the unit of space. If you do that, the result is the matter of A combined with the matter of B. These are the operations. Do not imagine there is anything mysterious about these terms. They are the operations about which you think every day of your life; and, I say, if you want to think philosophically about chemistry, you must embody in your symbol the very thing which you are thinking about, namely, the operation of combination itself.

I must not seek to explain to you now the process or method by which we arrive at the symbols of chemical substances, for to explain the process on the board, and to do it any justice, would occupy far more time than is at my disposal. You must allow me now simply to explain what we mean by the symbol of chemical substances (I mean in special cases), and then to consider the general results to which this mode of representation conducts us.

As to the mode of constructing these symbols, it is based in the most absolute way upon facts. We do not construct a symbol at all. We simply look for the symbol of matter and we find it. Where are we to look for the symbols of a chemical substance? Why, plainly to the symbols of matter in the gaseous condition: and where are we to look for the symbols of the operations by which units of matter are made? Why, plainly in the facts of combination. That is the source whence you are to deduce the symbol: it is the fact of combination itself. The facts in gaseous combinations are such as these:—2 volumes of hydrochloric acid consist of the same ponderable matter as 1 vol. of hydrogen and 1 vol. of chlorine. 2 vols. of gaseous water consist of the same ponderable matter as 2 vols. of hydrogen and 1 vol. of oxygen. Again (I will now put it in my way), 2 units of ammonia consist of the same ponderable matter as 3 units of hydrogen and 1 unit of nitrogen. These are the facts, and chemistry supplies us with a vast, but not an infinite number, of such facts. The method which I have ventured to give is simply a method of expressing the facts of the equation in the symbol of the substance. It is simply and purely a method of taking an equation, and of embodying in the symbol the facts of the equation. Through the facts of the equation we construct the symbols of the units of ponderable matter. We then take the symbols out of the equations, and we thus separate and analyse the facts one from the other. It is simply an analysis of facts of a peculiar kind.

I have constructed some tables expressive of the general nature of the conclusions, at which we arrive through the aid of this method, as to the composition of these units of matter. I have had a good many of these symbols written out, for really it is easier for you, by looking at these tables, to see the general results which we arrive at by this method, than it would be for me to enter into a long explanation of the process. Here you see are the symbols of the chemical substances. We start with the symbol of the unit of space.

Symbols of the Units of Chemical Substances.

Unit of space	1
Hydrogen	α
Oxygen	ξ^2
Water	$\alpha\xi$
Peroxide of Hydrogen	$\alpha\xi^2$
Sulphur	θ^2
Protosulphide of Hydrogen	$\alpha\theta$
Bisulphide of Hydrogen	$\alpha\theta^2$
Sulphurous Anhydride	$\theta\xi^2$
Sulphuric Anhydride	$\theta\xi^3$
Sulphurous Acid	$\alpha\theta\xi^3$
Sulphuric Acid	$\alpha\theta\xi^4$
Chlorine	$\alpha\chi^2$
Hydrochloric Acid	$\alpha\chi$
Hypochlorous Acid	$\alpha\chi\xi$
Chlorous Acid	$\alpha\chi\xi^3$
Chlorosulphurous Acid	$\alpha\chi^2\theta\xi$
Hypochlorosulphurous Acid	$\alpha\chi\theta\xi^3$
Chlorosulphuric Acid	$\alpha\chi^2\theta\xi^2$
Iodine	$\alpha\omega^2$
Bromine	$\alpha\beta^2$

In the next table is another system of symbols, those of the combination of carbon, hydrogen, and two or three other elements.

Carbon	κ^2
Acetylene	$\alpha\kappa^2$
Marsh Gas	$\alpha^2\kappa$
Olefiant Gas	$\alpha^2\kappa^2$
Carbonic Oxide	$\kappa\xi$
Carbonic Acid	$\kappa\xi^2$
Alcohol	$\alpha^3\kappa^2\xi$
Ether	$\alpha^5\kappa^4\xi$
Glycol	$\alpha^3\kappa^2\xi^2$
Glycerine	$\alpha^4\kappa^3\xi^3$
Anhydrous Acetic Acid	$\alpha^3\kappa\xi^3$
Tetrachloride of Carbon	$\alpha^2\chi^4\kappa^2$
Chloroform	$\alpha^2\chi^3\kappa$
Chloracetic Acid	$\alpha^2\chi\kappa^2\xi^2$
Trichloracetic Acid	$\alpha^2\chi^3\kappa^2\xi^2$
Chloride of Benzoyl	$\alpha^3\chi\kappa^7\xi$
Cyanogen	$\alpha\nu^2\kappa^2$
Hydrocyanic Acid	$\alpha\nu\kappa$
Methylamine	$\alpha^5\nu\kappa$
Mercuric Ethide	$\alpha^5\kappa^4\delta$

You must regard these symbols as being chemical equations turned into another form, and divested of a certain amount of superfluous and useless matter, which we do not want now to consider or think about. Nature does not supply us with the key note to enable us to construct a definite system of chemical symbols. Nature does not tell us absolutely—though I think she does tell us probably—how we are to proceed to construct a system. In order to be able to construct a chemical system we must start with a hypothesis of some kind or other. As we go on constructing our symbols, of course our hypothesis, as we prove it, becomes a fact; but we must,

at any rate, start with some hypothesis; that is to say, we must know one symbol. We may construct a complete chemical system from one symbol; and we may view all these symbols as taken from one hypothesis, combined with the facts given to us and supplied by the equation. Now, that hypothesis is this, that the symbol of the unit of hydrogen is expressed by one letter, α. That is my starting point; and I should say that the symbols which you see in the tables, as indicating chemical operations, are regarded as symbols of primary operations, that is to say, operations which you cannot resolve or decompose into any other symbols.

They are symbols of the primary operations; and when I say that the symbol of hydrogen can be expressed in chemical equations by one letter, I mean that in the changes and transformations of chemistry that unit of hydrogen is never broken up; that it moves as a whole from system to system, and that that unit of hydrogen is never decomposed or resolved into parts. The unit of hydrogen is constructed at once, by one operation. What I mean is this: imagine yourself witnessing the formation of hydrogen. To form some substances you want many operations; but to form hydrogen you want only one operation. That [striking a blow on the glass model of the unit of space] represents the formation of hydrogen, —one operation. It is one act. If we could witness chemical transformations, and nature would only become vocal to us, and indicate each combination as it occurred, by a musical note, that [again striking a blow] is what you would hear when hydrogen was formed. Now, as we go on we come to much more complex substances. Let us take oxygen. This is a substance very different indeed from hydrogen in its chemical properties; and as you can conceive of the unit of hydrogen being made at once by one operation, I say that it is impossible for you to conceive of the unit of oxygen being made by less than two operations. To return to our metaphor, when you take water and decompose it, and when you hear the oxygen go away, you ought to hear two notes, like this, [striking two blows in close succession.] That is what I mean by saying that oxygen is made by two operations. Again, the unit of water is made by two operations like the unit of oxygen; but it differs from the unit of oxygen in this respect, that one of those operations is the same as that by which hydrogen is made, and the other is the same as that by which oxygen is made. That is to say, in the operation by which water was formed, you would hear two sounds, one different from the other, α, ξ.

The symbol of chlorine is $\alpha\chi^2$. Chlorine, from this point of view, is to be conceived as made up of three operations. You are to hear χ, χ, and then α again. One of these operations is the same as that by which hydrogen is made, and the other is an operation peculiar to chlorine itself, namely, χ. Again: a unit of hydrochloric acid —a thousand cubic centimetres, in the condition of a perfect gas at a pressure of 760 millimetres—is to be conceived of as made by two operations, $\alpha\chi$.

To go one step further: let me refer you to this table:—

Nitrogen	$\alpha\nu^2$
Ammonia	$\alpha^2\nu$
Protoxide of nitrogen	$\alpha\nu^2\xi$
Nitrous acid	$\alpha\nu\xi^2$
Nitric acid	$\alpha\nu\xi^3$
Phosphorus	$\alpha^2\phi^4$
Phosphide of hydrogen	$\alpha^2\phi$
Hypophosphorus acid	$\alpha^2\phi\xi^2$
Orthophosphoric acid	$\alpha^2\phi\xi^4$
Terchloride of phosphorus	$\alpha^2\phi\chi^3$
Pentachloride of phosphorus	$\alpha^3\phi\chi^5$

Nitrogen is to be conceived of here as made of three operations, $\nu\nu$, and then α upon that. In the formation of the unit of ammonia three operations concur. One of them being one of the operation of nitrogen, ν, and the other two being the operations by which hydrogen is formed, α.

I must not enter into further details upon this subject, but I have little doubt that, with this explanation, you will readily appreciate the meaning of the symbols which are written up before you. You will see that, by following this process of taking the facts of the equations and turning them into the language of symbols, we arrive at a peculiar view as to the nature of matter, which view is embodied in those symbols.

Now, as to the nature of the view which is here indicated, for that, perhaps, will occur to most persons, as the most important point to be considered. This view is the only result which I have placed before you, in the first part of this method. It is the view as to the nature of matter itself. You will observe that, looking simply from the general point of view of the nature of matter, the point which it is most important for us to insist upon is the nature of the elemental bodies, because it is out of these elemental bodies that everything else is made, and into them all things are capable of being resolved. The view which we take of these bodies gives to us implicitly the view which we are to take of the composition of every other body whatever. To understand this it is only necessary to appreciate the view which is here given of the nature of the elements themselves, and everything else follows from that. We are led to the following singular results,—that, speaking generally, there are, perhaps, four—certainly at least three—fundamentally distinct classes of the elemental bodies.

First of all, there are elemental bodies, the units of which are made by one indivisible operation. These bodies are represented to us by mercury and hydrogen. To this class also probably belong such elements as zinc, cadmium, and tin; but we cannot speak with great confidence on that point.

Secondly, we have a class of double elements, formed by two similar operations, these are oxygen ξ^2, sulphur θ^2, selenium λ^2. Carbon we are not certain about, it belongs, in all probability, to the first or second class, we do not quite know which; but I have symbolised it as κ^2.

But we have another and a very large class—perhaps the largest of all the groups of the elements—and we may take the elements chlorine and nitrogen as representatives of it. Here is the symbol of the element chlorine, $\alpha\chi^2$; here is nitrogen, $\alpha\nu^2$; here is iodine, $\alpha\omega^2$; and so on. You will see that the symbols of these elements occupy a certain intermediate position between this group of elements, α, δ, ζ, &c., and that group of elements, ξ^2, θ^2, λ^2, &c. We have many compound substances which are in every way analogous to this group of elements—analogous as to their properties, analogous as to their symbols. Of this class we have a most interesting and striking example in the peroxide of hydrogen; it is symbolized here as $\alpha\xi^2$. You see the peroxide of hydrogen is really to be regarded as the combination of one unit of the element hydrogen with one unit of oxygen—which things really exist—just as the element chlorine may be regarded as a combination of the unit of hydrogen (α) with a substance which does not exist, and which I have symbolized as χ^2. The unit of nitrogen is to be regarded as similarly composed ($\alpha\nu^2$). We may regard it as α combined with the unknown element ν.

There is one question which must occur to every one, the explanation of which is of fundamental importance to the comprehension of this system. You may ask me, "What do you mean by these symbols—by calling chlorine $\alpha\chi^2$; nitrogen, $\alpha\nu^2$; oxygen, ξ^2?" Do you mean that there are certain portions of matter, really existing, capable of being brought to the lecture-room—theoretically, at any rate—and shown upon the lecture-table: portions of matter which are represented by α and χ, α and ν, and so on? Do you mean this? or do you mean that these things are the creations of your imagination—that they are fictions—illusions? We like," perhaps you

may say to me, "we like Dalton a great deal better than we do you; for Dalton, at any rate, dealt with realities, or possible realities. He, at any rate, showed us the matter of which all substances are made. He brought the elemental bodies into the lecture-room in bottles, and he showed us there the elements out of which matter is made. Are you going to do that? Do you mean to show us α, ξ, χ, in the lecture-room? Again, Dalton dealt with realities through these atoms. Although, certainly, we have never seen them, yet, nevertheless, we most perfectly believe them to exist. There are such things as atoms, although we have never seen them. Dalton brought the elements to the lecture-table; and if he did not actually show us the atoms, you will find pictures of them at the end of his book;—he made little bits of wood which were excessively like atoms, although they were wood. But you don't even do this for us." Well, this is rather a perplexing question; for if you ask me if these things really exist—whether they are things capable of being brought to the lecture-table and placed before us—in answer to such an enquiry I say, in the first place, that they do not necessarily exist. Then, again, you ask me this: "Do you say that they are imaginary things; that they are creations of your fancy? Because, if so, we don't trouble ourselves much about your fancies. They are not worth thinking about." I say, no, they are not fancies of mine; I never made them? I only found them. Then you answer: "All things are either imaginary or real: which are these?" Well, I reply, these things are *ideal* things. Well, then, my friend says I am getting beyond him when I say these are ideal, for he does not understand what ideal things are: all things are either imaginary or real. Yes; but I say there is a point which you have overlooked. Either all things exist according to the laws of nature which make it possible for them to exist, or there are insuperable barriers in the laws of nature to their existence. But though we may not know whether certain things exist or do not exist, yet we may reason about these things as if they were real things. A thing may not exist at all, but yet it may serve to us all the purposes of a real thing. That is what I mean by an ideal thing. It is a thing which may exist or may not exist, we do not know which, but which satisfies all the conditions of reality.

I shall venture, at the risk of delaying you a little longer, to give you an illustration on this point, which was suggested to me by some remarks and illustrations of Professor Stokes, with whom I have had the, to me, incomparable advantage of discussing and considering several of these difficult and abstruse questions. My illustration is simply his illustration a little modified for you. I am going to make a general assertion. I will draw a conic section—a curve—on the board, and I am going to say that every straight line cuts every conic section in two points. That, you see, is somewhat analogous to my statement, that the unit of every chemical substance is composed of an integral number of prime factors, and is to be regarded as made up of an integral number of these bits of matter which I call symbol weights. There are the two corresponding assertions. But you say, "Do you mean that every straight line really cuts the conic section in two points?" I say, no, I never said that it *really* cut it at all. I said it *cut* it. Then you say, "Do you mean that it cuts in imagination?" I say, no, I do not say this. I do not know whether the line cuts it in reality or in the abstract. I do not know, speaking generally, whether the points at which a straight line cuts a conic section are real or imaginary. They are one or the other. You see that is a perfectly general mathematical truth and principle. Nothing is easier than to prove any proposition; and I may go on to say, that in the case of a straight line, of course, we can go farther: we can investigate the nature of these points; we can determine the nature of these points. But in chemistry we come to a bar. We cannot go on. We have not yet got the data to prove whether these prime factors, these units of weights are real things or imaginary. They are undoubtedly one or the other, but we cannot tell which. There are facts here which satisfy all the analytical conditions of the facts, whether the matter is real or imaginary. There are symbols of facts which satisfy the analytical conditions supplied to us by the equations of chemistry, and as such we are bound to accept them. We cannot do otherwise. It is impossible for us not to accept the conclusion.

We cannot, however, entirely dismiss from our consideration the alternative that these portions of matter—α, χ, ξ, ν, and ω, may be real. I *mean* a real thing when I say "a real thing." I mean something which may be brought to the lecture table and put there, really or theoretically. We cannot close our eyes to that alternative; and there really are, though not at all derived from this method itself, but derived from other considerations, certain real reasons which would lead us to suspect that chemical substances are really composed of a primitive system of elemental bodies, analogous in their general nature to our present elements, some of which we possess, but of which we possess only a few. I will take the case of the peroxide of hydrogen. I will throw overboard oxygen and a great class of certain oxygenated combinations, and I will suppose for the moment that I have these combinations—hydrogen, water, peroxide of hydrogen, and certain other substances which I could specify. If I were to apply my method to finding the symbol of peroxide of hydrogen, not regarding the oxygen at all, the symbol at which we arrive for peroxide of hydrogen is $\alpha\xi^2$. Thus the same question would arise in that case about peroxide of hydrogen as now arises about chlorine. In peroxide of hydrogen we really have succeeded in separating the elements which it contains, and this fact leads us to the suspicion that some of these bodies which we speak of as elements may in fact be compounds. In short, we are led, through our method, to a certain physical hypothesis, of whatever value that hypothesis may be, as to the origin and causes of chemical phenomena.

Now, what I am going to suggest is of course put before you with reservation, but we may conceive, that, either in remote time, or in remote space, there either did exist formerly, or there do exist now, certain simpler forms of matter than we find upon the surface of our globe—α, χ, ξ, ν, and so on—in short, these symbols of chemical operations. I say we may at least conceive of, or imagine, the existence, either in time or in space, of these simpler forms of existence, of which we have some records remaining to us. Here they are—hydrogen and mercury—two things. We may consider that in remote ages the temperature of matter was much higher than it is now, and that these other things existed then in the state of perfect gases—separate existences—uncombined at any rate. This is the farthest barrier to which we can reach. There may be something farther, but if so, we can have no suspicion of it from the facts of the science. We may, then, conceive that the temperature begins to fall; these things begin to combine with one another. They enter into new forms of combination, appropriate to the circumstances in which they are placed. The result is the formation of new combinations. We may suppose that at this time water ($\alpha\xi$), hydrochloric acid ($\alpha\chi$), and many other bodies, began to exist. Now, we may further consider that, as the temperature went on falling, certain forms of matter became more permanent and more stable, to the exclusion of others. We have evidence on the surface of our globe itself, of the permanence of certain forms of matter to the exclusion of others. We may conceive of this process of the lowering of the temperature going on, so that these substances, $\alpha\chi^2$ and $\alpha\nu^2$, when they were once formed, could never be decomposed,—in fact, that the resolution of these bodies into their component elements could never

occur again. You then have something of our present system of things. You might yet imagine that it would be possible, on looking carefully at chemical equations, and minutely studying them, to recover from the equations the record of the truths which were buried and preserved in the equations; and some analyst might come and say, "These equations are *only* consistent with this hypothesis, that chlorine is composed of α and χ^2," or, at least, it might be said that the equations *are* consistent with that hypothesis, for I do not want to go farther than that. In short, we can conceive of such a state of things. Now, this is not really and purely an imagination, for when we look upon the surface of our globe, as I said before, we have evidence of similar changes in nature. We talk of the elemental bodies as though they were existing things; but where are they? We have oxygen, nitrogen, sulphur, certain metals, and certain bodies which we could specify, but what has become of the others? Where is hydrogen? Where is chlorine? Above all, where is fluorine? Where are these things? Why, they are at any rate locked up in combination, in such a way that it is only within the last hundred years that the art of the chemist has revealed them to mankind. Now, if in our globe there had been more hydrogen,—if there had been an excess of hydrogen present in the matter from which our globe was made,—and if we suppose it to be true that the gases condense in the solid matter of our globe, we cannot doubt that the whole of the free oxygen would have been carried away from our planet, and that we should have had simply oxygen stored up in the form of water. We should have had water, but no oxygen at all; all the hydrogen would have combined with it and carried it all away.

When we look at some of the facts which have been revealed to us, by the extraordinary analyses which have been made of the matter of distant worlds and nebulæ, by means of the spectroscope, it does not seem quite incredible to me that there may even be evidence, some day, of the independent existence of such things as these, χ and ν. We know that Dr. Miller and Mr. Huggins saw a most wonderful hydrogen combustion—at least, what they imagined to be a hydrogen combustion—taking place in a variable star. Now, for aught we know to the contrary, this hydrogen combustion might be merely hydrogen combining with unknown elements, and carrying them all away in the form of chlorine, nitrogen, and the like. One of the nebulæ examined by Dr. Miller and Mr. Huggins afforded them the spectrum of an ignited gas, and in the spectrum of the nebula they saw one of the lines of nitrogen alone. Now, this suggests that this line might have been produced by one of the elements of nitrogen, before it had combined with another substance to form nitrogen. That might have been the element, ν. I am only suggesting that; but I say that if we follow up the subject we may have, one day revealed to us, independent evidence of the existence of these elements.

Let me, in conclusion, make one or two observations upon a point which, of course, must occur to every chemist who has studied this method. If we had taken, not α as the symbol of hydrogen, but had started with a different hypothesis, namely, that the symbol of hydrogen was α^2, we should, of course, have arrived at a different symbolic system, that would have been analogous in its form to our present symbolic system—that is to say, you might have given to it an interpretation analogous to that system. We should have had hydrogen as α^2; water $\alpha^2\xi$, and so on. In fact, we should have been led to develop a system different from that which I have brought before you. You may with reason ask me, "Why do you prefer one of these systems to the other; or do you prefer it; or what view do you take of that question?" Let me say, in the first place, that my object has been, hitherto at least, not to give you a very definite answer to this question. For I have not yet placed before you and others, the ideas upon which a judgment can properly be formed on the question; but it is certainly true, in a certain sense, that there is more than one answer to the chemical problem, and that this system as thus developed, leads to another solution of the question. It gives you another answer to your inquiry. But further than this, there may be other answers still, although, perhaps, these are the only two answers necessary in considering the chemical problem; and this point which I wish to bring before you is of a far more subtle nature than it has been suspected to be. It is a method which you cannot attempt by the modes of atomic symbolism. It may be regarded as an equation of which there are not only one root, but several roots. Some of these roots may be thrown away, but some may lead us to a real solution. Now, I am not saying that one answer is the same in kind as the other answer, for I, with a natural preference, select the system α. I think there is something there, which is really of more importance and more necessary, in expressing the symbols than that which is given in the second system. I do not at all disregard that system. Indeed, I shall hereafter consider it, and endeavour to see, at any rate, what it means; but, I say, there is something in my system which is not in the second system—something in the system of α, which is not in the system of α^2. I cannot discuss this question with the hope of producing conviction in your minds, but I will just point out one fact. It is this,—that you can pass from the system of α to the system of α^2 by a direct process of substitution. I mean, that if you say that here are two independent systems—the system of α, and the system of α^2—I say those systems are not entirely independent; for if you have constructed the system of α, you can make a substitution of α^2 for all. What that system would be, it is not necessary here to imagine. But having constructed this system of α^2, you cannot go back. It is not a logical consequence at all that, because you can take the square of the first system, therefore you can go back again. It will be absolutely impossible to pass at all from the latter system to the former. The one is derived primarily by substitution, and the other is not derived purely by substitution, but first by substitution, and then by reduction.

Discussion.

Dr. Frankland: I am sure, sir, that I only express the feelings of everyone present when I say that I have listened to the lecture which Sir Benjamin Brodie has just given us with great interest and admiration. I cannot help thinking that the bringing forward of an entirely new method of viewing chemical phenomena such as has been brought before us to-night, must be fraught with great good to the science; but at the same time, I may be permitted, perhaps, having been alluded to in the earlier part of the lecture as a prominent advocate of what might be termed the opposite system of representing chemical facts, to protest at the outset, in the most emphatic manner, against the view which Sir Benjamin Brodie appears to have of such representations. I am not going to speak on behalf of other chemists who employ those more concrete modes of chemical representation. On my own behalf, however, in repudiation of the notion that I regard such representations as these graphic or glyptic formulæ, or even symbolic formulæ by letters only, in the sense of representations of the constitution of those portions of matter called atoms, or as representations of the position of these atoms in the compound; perhaps I cannot do better than state, simply and at once, that I neither believe in atoms themselves, nor do I believe in the existence of centres of force, so that I do not think I can be fairly charged with this very crude notion which would otherwise attach to me with regard to the representation of such chemical compounds. Now, sir, many people, I believe, have been much dissatisfied of late with chemical formulæ in one respect, and I confess that I am

one of the most dissatisfied. This note of dissatisfaction was, I believe, first expressed by Mr. Waterston. We do not express in our chemical formulæ, and in our chemical symbols, the idea of the *force* which has been involved in the operations expressed in those chemical compounds to which we apply the formulæ; and I think that one of the greatest advances which could possibly be made in the notation of chemical compounds, would be the introduction of this element. When, however, we leave statical formulæ—when we leave the mere representation of the atoms of compounds (if you will allow me figuratively, for a moment, to use the expression)—and when we go to the operations themselves by which those compounds are formed, I think we require then this expression of the forces involved, still more than we do in the statical formulæ that have hitherto been employed by chemists. Now, it appears to me, that we seek in vain for this element in the new development which Sir Benjamin Brodie has so eloquently placed before us this evening. Again, I think that every chemical formula is of use chiefly, if not only, as a means for future discovery in nature. So far as it serves that purpose it is of use, if it does not serve that purpose it is useless. The more, therefore, that a chemical formula expresses of our knowledge of the body for which we put it, the more valuable, I apprehend, that formula is. Now, if we take two well-known chemical compounds—namely, nitric acid on the one hand, and sulphuric acid on the other hand—I believe that if there is anything that we do know with certainty regarding these two acids it is this: that in the case of nitric acid the hydrogen present in that compound can be taken out of it in one piece only, whilst in the sulphuric acid you can take out the hydrogen in two pieces. Now, when I look at the formula of nitric acid $\alpha\nu\xi^3$, and of sulphuric acid $\alpha\beta\xi^4$, I find in both these formulæ the same expression for the hydrogen; so that, I say, there is not contained in that formula the same amount of information, and of the most essential information, with regard to these two acids, that we possess in the present formula, differ as they may amongst different chemists, and lamentably they do so differ; still, by almost every chemist those two acids are expressed by formulæ representing this peculiarity of the hydrogen in those two compounds. These new formulæ, I say, do not express that idea, do not give us that information. I certainly do not imagine that any evil is likely to arise from such symbolical representations as have been hitherto used, even those of the very crudest kind which have been so strongly censured by Sir Benjamin Brodie; and, further, I do not think that science would ever suffer from the legitimate use of hypothesis. In fact I cannot conceive of the future progress of science without such use of hypothesis; and I must say that it is to me a great recommendation for the new notation which has just been placed before us, that it involves a very fair amount of such hypothesis, which, I hope, will be capable of being used for the advance of the science, and for the benefit of its representations.

Professor Clerk Maxwell said he confessed that when he came into the room his feelings received a wholesome shock from two of the statements in the diagrams—first, that space was a chemical substance, and second, that hydrogen and mercury were operations. He now, however, understood what was meant. The present seemed to be an endeavour to cause the symbols of chemical substances to act in the formulæ according to their own laws. The formulæ at present used were made to express many valuable properties of chemical substances, just as a great many formulæ were employed to represent the syllogism in logic, which required a logical mind to form them, to understand them, and to reason upon them. The only successful attempt to introduce a new system in the logical representation was that of Mr. Boole, who accomplished it by the metaphysical and mathematical conception that x^2 was equal to x. In Sir Benjamin Brodie's system a did not mean exactly "hydrogen," but "make hydrogen;" that is, take the cubic centimetre of space, and put hydrogen into it of the proper pressure and temperature. But if they were to compress into that space another volume of hydrogen, that would not be a^2, because it would increase the pressure to double what it was before. If it were possible to get a^2, they would require to combine two volumes together by a process unknown to chemists, keeping the pressure and temperature as before. There was, in this respect, no doubt, an idea which differed from the mere collocation of symbols. The unit of ponderable matter described in the system was one which had been derived by chemists from chemical considerations alone. It had also been advocated by physicists from considerations derived from the theory of heat. In order to decide with certainty on the truth or falsehood of the atomic theory, it would be necessary to consider it from a dynamical point of view. He meant that kind of dynamics treated of in books on mechanics. It was worth while to direct the attention of chemists to the fact that a belief in atoms conducted necessarily to exactly the same definition as was given there—namely, that for every kind of substance the number of atoms, or molecules, in the gaseous state, occupying the space of a litre, at a temperature of 0 degrees, and of a pressure of 760 millimetres, must necessarily be the same. That was a consequence which could be deduced from purely dynamical considerations on the supposition advocated by Professor Clausius and others, that gases consist of molecules floating about in all directions, and producing pressure by their impact. That theory was now under probation among chemists, physicists, and others. The next step was one which might be far off—the finding of the number of these molecules. That number was a fixed one; and when it could be arrived at, we should have another unit of ponderable matter—that of a fixed molecule.

Professor Stokes (on being invited by the President to join in the discussion) said he had very little to add to what had been said; but referring to the way in which the symbols of some of the elements were arrived at, he might say they were based upon the known laws of combination by volume. The chief feature which struck him in the system of Sir Benjamin Brodie was, that it allowed them to express the composition of bodies by a method which took in all their existing knowledge, and did not assume anything besides. Of course the mode of expression was liable to change with an increase of knowledge; but taking their knowledge at a fixed point, such as it was at the present day, the method expressed everything that was known without superfluous hypotheses. The question of binoxide of nitrogen was a very important one; for if the known vapour density of that substance was to be admitted, it would seem to resign the question in favour of Laurent's system. On the other hand, if they agreed to pass over that anomaly for the present—and all chemists would admit that there was an apparent anomaly about it—then they were led to Sir Benjamin Brodie's system.

Mr. Wanklyn said the remarks of Professor Stokes had suggested what probably would occur to every one in the room—that the new method was a one-volume system. The well-known system of Gerhardt was a two-volume system.

Dr. Odling: The pleasure with which I have heard Sir Benjamin Brodie's lecture is, I am afraid, almost counterbalanced by the shock which my feelings received on hearing from Dr. Frankland that he questioned the positive existence of atoms. If Dr. Frankland's opinion on that subject was what he has stated, he has grossly deceived the chemical public. (Laughter.) The Chairman has said quietly aside to me that, after all, Dr. Frankland never really believed in atoms, or he would not have ventured to take such liberties with them. We have been led to believe that not only have we atoms, but that these atoms

possess imaginary prongs, and that there is an imaginary clasping between them by means of these imaginary prongs, in a sort of hermaphroditism which it is scarcely possible to refer to. It behoves chemists to give their attention to this matter, as it affects their fundamental notions of chemical constitution and chemical change. After all, the system of symbols is a method of expression, and its value must depend upon its usefulness, upon the accuracy with which it expresses, and the facility with which it can be used. The accuracy with which Sir Benjamin's system can express, has been brought out in the part of his paper already published; but we wait for information on the facility with which the method can be used, and the advantages attending upon its use. It appears to me to possess one prominent merit, and that is expressed by the author in his paper—that the expressions are brought into immediate relations with the facts themselves. The present method of chemical expression, really, is not based directly upon the facts, but upon the facts through the intervention of the atomic theory. There is nothing of this kind in the method which the lecturer has introduced to the Society. No doubt the expression bears a relation directly to the fact, be the theory what it may. In the ordinary use of our present symbolic language, there are some chemists who, differing from Dr. Frankland, do believe in atoms, but who, not differing from Dr. Frankland, bring the idea of atoms prominently forward. On the other hand, there are some who, like myself, do not believe in atoms, and who keep the idea of atoms in the background as much as possible. But whether we do or do not believe in atoms, it still remains true that our notation is based upon the atomic theory, and without the atomic theory our language has no meaning whatever. One of the advantages of the new method is, that it is not inconsistent, by any means, with the atomic theory; but it is not based upon it. Another point of view from which the system commends itself even more strongly to our attention, is that which has been adverted to by Mr. Wanklyn, and which it does not require anybody to point out—namely, that it is a one-volume system, while the method which has been hitherto in use is a two-volume system. Laurent, however, has also introduced a one-volume system; but in that of the present author there is this additional feature: that it is the only mode introduced to chemists by which the volumes of substances can be represented by integral numbers without fractions. In Laurent's system there are fractions. It seems a thing altogether ridiculous that, under any system, we should adopt, as a unit of chemical substances, that which consists of two units, and which we are obliged to express in every way as consisting of two units. The new system is the first in which all prime factors can be written by an integral number. Another point of interest is the dissipation of that extraordinary law of even numbers which was brought into notice by Laurent and Gerhardt. Why that law should exist upon the atomic hypothesis, which is a dualistic hypothesis—the hypothesis which also exists in the expressions based on Laurent's one-volume system—is truly inconceivable; but in the mode of expression introduced by Sir Benjamin Brodie, this disappears altogether, and we get, at any rate, an entire series of compounds formed by the simple increment of atoms, one upon another, and without any of the objections which the ordinary formulæ present. Dr. Frankland has adduced, as a recommendation to this method, that it really introduces a great deal of hypothesis. There is no doubt that the whole system, as compared with the system of a^2, is based upon an hypothesis; but with the exception of that hypothesis, I do not think that there is anything hypothetical in the whole system. Admit, for one instant, the not improbable hypothesis that the unit of weight of hydrogen is an indivisible quantity, and all the remaining portion follows as a matter of course. There remains only the question whether the consequences, which the adoption o such an hypothesis leads to, are of such a character as to confirm the hypothesis, and, in fact, to demonstrate its truth. On that point I must say that I feel the difficulty which has been suggested by Dr. Frankland respecting the bodies which chemically behave in a different manner, and which are distributed in a different way, although, judging from their mere formulæ, it would be supposed that they should be distributed in an identical way. We have no means of separating, in our minds, that hydrogen which is distributable from that which is not. Altogether, I view the paper as of very great use to chemists, as calling upon them to consider the grounds upon which their present opinions are based, and as shattering to the ground a great many of the superstructures which have been raised upon the old theory. The paper is of the highest importance and the greatest interest. I feel, as many must have felt upon former occasions, that a blow has been given to one's long-cherished convictions. But, at the same time, I am not at the present moment inclined to abandon them altogether. I look upon myself as vanquished for the moment, but I am not altogether disinclined to renew the combat, when further knowledge shall give me the means of doing so.

Mr. Brayley said that it appeared that one of the most striking and important elements of the subject which Sir Benjamin Brodie had placed before the Society, had not been adverted to by any of the gentlemen who had joined in the discussion. That was, the probability which it shadowed forth of discovering the compound nature of some of our present elements by a kind of chemical calculus. Professor Stokes had characterised the new method as embodying the representation of all we knew, but it appeared to add to this a hypothetical shadowing forth of what we might hope to know hereafter. It would be acceptable to chemists if the author would have the goodness to explain the manner in which he arrived, by his method, at the conclusion that whatever was represented by a (whether hydrogen or any other substance) was contained in all those haloid elements to which the sign of a was attached, such as chlorine, iodine, and bromine.

Mr. Foster said he thought the point which must strike chemists, at first sight at any rate, as the most interesting result of Sir Benjamin Brodie's method, was that it enabled them to arrive at the conclusion that some elements were, in point of fact, compounds. This, however, was by no means the first time it had occurred in the history of the science that chemists had arrived, by pure reasoning, at the conclusion that some substances, whose elements they did not know, were compounds. For instance, before it was known that the alkalies and the alkaline earths could be separated into oxygen and a metal, the majority of chemists were pretty well convinced that they were compound substances. And with regard to chlorine itself, that substance was, at its very discovery, viewed in a manner which was analogous to, if not, in point of fact, identical with, the view which was indicated by Sir Benjamin Brodie's notation. Hydrogen, hydrochloric acid, and chlorine were regarded in early times as bodies which formed a series with each other, hydrochloric acid being exactly half-way between hydrogen and chlorine. One point which had been alluded to, as well by Dr. Frankland as by Dr. Odling, was that the symbols exhibited in the diagram did not, in all cases, express quite as much, from some points of view, as the ordinary chemical formulæ. For instance, the formulæ of sulphuric acid and of nitric acid did not show that the sulphuric acid was what was commonly called bibasic, and nitric acid monobasic. That, he thought, was hardly a fair criticism upon the formulæ. For sulphuric acid the symbol was $a\theta\xi^4$; for nitric acid the symbol was $a\nu\xi^3$. But although the symbol representing hydrogen occurred merely once in each formula, still, having regard to the other letters, these tell us that the hydrogen is distributable in one case and not in the other. Take again the similar cases of water and hydrochloric

acid. The first was represented by $a\xi$, and the other by $a\chi$. One of the properties of the symbol χ was to render the a with which it was combined undistributable, whereas the ξ combined with the hydrogen rendered the hydrogen distributable; so that although a occurred once only in the formulæ of water and hydrochloric acid, the other letters showed that its properties varied. They should, therefore, judge of the formula, not by one of its signs alone, but by the varied meaning due to the collocation of symbols.

Dr. Williamson (Chairman): I cannot refrain from expressing on my own behalf, what I am sure must have been felt by all present—the strong sense of the obligation, under which we are placed to our eminent colleague, for the most laborious and most important work which he has been carrying on for many years, though it is only now becoming known to chemists. It is a peculiarly difficult thing to dissociate oneself from the prevailing ideas on such a subject as has been put before the Society; and yet such dissociation is essential to the working out of any truly new conception, and especially any new mode of expression. The novelties of expression which Professor Maxwell spoke of as having been a shock to him, are in themselves the essential condition of the working out of the new system of notation. One is, perhaps, pained on first hearing that 1 is equal to zero. Nor are we accustomed to understand an operation performed merely upon space. I must confess that although I have given considerable time and attention to the paper, I do not feel that I am in a condition to fully appreciate all the expressions used in that part of the system already published. There are some things which I feel hardly able to accept on the present basis; but, at the same time, I feel that until one can understand in plain English and in ordinary words the meaning of those operations and things denoted, it will be exceedingly presumptuous to doubt the correctness of results which have *primâ facie* evidence of great consistency. Every chemist must be struck with the unity and consistency of the new method; but those qualities cannot be attributed to the present system of notation. I am quite convinced that whatever modifications Sir Benjamin Brodie's system may undergo at the hands of its author, its introduction will inaugurate an exceedingly important era in chemical language and notation. I am sure the Society will join with me in thanking the author most cordially for the great intellectual feat which he has performed in working out this subject, and in hoping that before long he may accomplish some further steps in his great work.

The Lecturer's Reply.

Sir Benjamin Brodie: I do not know that there really remains very much for me to say upon this matter. With many of the remarks that have been made, both by Professor Frankland and by Dr. Odling, I cannot but agree. I think, myself, that the object of a method is not simply to give us statical formulæ, but that we must also consider the dynamics of the science. I mean, by "statical formulæ," that we are not merely to consider what matter is, but that we are to consider the laws also by which matter changes; and that is a point upon which I hope to throw some light at a future time, in the second part of the paper. It is then that the question will naturally arise as to the way in which the kind of facts, which it has been attempted to express by the theories of atomicity, will appear in this method. You must not suppose, because I have not entered upon these subjects, that I have ignored them; I only postpone the consideration of them. With regard to the other point, about the relative merits of this mode of statement and the one ordinarily in use, I think that some of the remarks of Dr. Frankland, and my friend Dr. Odling too, are based simply upon a misconception. Dr. Frankland seems to imagine, in the case of such symbols as those of nitric acid $a\nu\xi^3$, and of sulphuric acid $a\theta\xi^1$, that the important and fundamental distinction which is assumed in our present system to consist in the different number of atoms of replaceable hydrogen which these substances respectively contain, is altogether obliterated and lost sight of. But this is not so. By simple inspection of the symbols, you can ascertain precisely, as in our present notation, the changes of this order of which chemical substances are susceptible. But, as Professor Foster justly observes, you must take into account the whole symbol, and not a bit of it only. If you take into account the fact that the matter of all known chemical substances is identical with the matter of the elementary bodies, then there is nothing to be added. To one who is familiarised with the use of these expressions (when this point is properly regarded), it is at once apparent that, whereas we can perform two of the operations, for example, symbolised in χ, and two only of those operations, upon the symbol $a\theta\xi^4$, we can perform one, and one only, of those operations upon the symbol $a\nu\xi^3$. These important questions, however, cannot be thus briefly discussed, and I must defer their consideration to other opportunities.

MISCELLANEOUS.

Chemical Society.—The next meeting of the Society will be held on Thursday evening, at 8 o'clock, when the following papers will be read:—"*On Derivatives of Hydride of Salicyl*," by Mr. Perkin; "*Analysis of Biliary Concretion*," by Dr. Phipson; "*On Pyrophosphoric Acid*," by Dr. Gladstone.

Magnesium.—We understand that the Magnesium Metal Company are progressing in the manufacture of magnesium wire and riband. They have found from experience that if magnesium riband is pressed broader and thinner, and by this means made to present a larger surface to the oxygen of the atmosphere for the same weight of metal, it burns much more steadily and surely. They are now supplying the metal in this form.

Extractum Conii.—Dr. John Harley has proved by experiment that the ext. conii is a very uncertain, if not an inert, preparation. He attributes this to the fact that the active principle of the plant is, to a certain extent, vaporisable, even at a natural temperature of 70° to 90° Fahr., and that a prolonged exposure to a high temperature is accompanied by a progressive diminution of the conia, the alkaloid being converted into ammonia and some other secondary product. It is, therefore, necessary, in order to obtain an extract of full power, to expose the juice in shallow dishes to a rapid current of dry air having the temperature of 150° Fahr. By this process, an extract containing one per cent. of conia may be procured.—*Pharm. Journal.*

Sublimation of the Alkaloids.—Dr. Guy suggests the following mode of procedure:—Provide small crucible covers or slabs, or fragments of white porcelain, a few microscopic cell-glasses, with a thickness of about one-eighth of an inch and a diameter of circle of about two-thirds of an inch, and discs of window-glass about the size of a shilling. Place the porcelain slab on the ring of a retort-holder, then the glass cell, and upon the porcelain, in the centre of the cell, a minute portion of the alkaloid or other white powder or crystal reduced to powder. Then pass the clean glass disc through the flame of the spirit lamp till the moisture is driven off, and adjust it over the glass ring. Now apply the flame to the porcelain, underneath the powder, and continue to heat till the powder undergoes its characteristic change and gives off vapour. Watch the deposit of this vapour on the glass disc, and remove the spirit lamp, either directly or after a short interval, as experience may determine. By this process Dr. Guy has succeeded in getting very beautiful crystalline sublimates

of morphia, strychnine, solanine, and cryptopia. He recommends it in preference to that of Dr. Helwig.—*Pharm. Journal.*

Cryptopia.—Messrs. T. and H. Smith have discovered a new alkaloid in opium, which they have named cryptopia. It is extracted from the weak spirituous washing of crude precipitated morphia, but the quantity yielded by opium is very small, Messrs. Smith having operated upon four or five tons of opium, and only obtained five ounces of muriate of cryptopia. They have prepared the sulphate, muriate, nitrate, thebolactate, and the acetate; these all crystallise in beautiful and distinct forms, but the alkaloid itself has much better defined crystalline forms than any of its compounds. Its primary form is a hexagonal prism, and it is obtained in this condition if crystallised slowly in a tube from its alcoholic solution. The formula of the new alkaloid is $C_{23}H_{25}NO_5$.—*Pharm. Journal.*

Preparation of Hydrate of Sodium from Sodium.—At the recent *soirée* of the Pharmaceutical Society, a large block of pure fused hydrate of sodium, prepared from metallic sodium, was exhibited, and excited much attention. It is thought that a short account of the means adopted to oxidise so explosive a substance may not be without interest to our readers. Sodium, as prepared for the market, is cast in moulds, which are well smeared with oil, which coats the metal and prevents it oxidising; but the sodium from which the hydrate is made is cast in bright clean moulds. When removed it is well rubbed with a clean linen cloth, in which it is encased to prevent contamination from the atmosphere. The bars of sodium are now cut into lumps about one inch square. One of these lumps is thrown into a perfectly clean silver dish, which floats on a stream of cold water. A few drops of distilled water are poured on the sodium, and the vessel is well agitated by hand, which prevents explosions. When the first lump of sodium is dissolved, another piece is thrown in, additional drops of water are added, and the vessel kept constantly agitated, and so on throughout the operation. After a deposit of soda forms at the bottom and around the sides of the vessel, and the liquid becomes completely saturated, the tendency to explosions seems much reduced. If the dish remains quiet, great amount of heat is generated, and the fusing sodium bursts out like a tiny volcano, scattering globules of fire—*i.e.*, burning sodium—all around; but if the vessel is kept in constant motion, a fresh surface of cold water is brought into contact with the fusing sodium, its temperature is reduced, and explosions are almost prevented. The milky liquid thus prepared is now filtered, and then fused in a silver crucible, over a gas furnace, to a dull red heat, or until all moisture is driven off and the liquid becomes perfectly transparent. The crucible is carefully covered up, and the contents allowed to cool; but as the hydrate of sodium is very deliquescent, absorbing moisture even when too hot to be handled with impunity, it is removed from the crucible whilst warm, quickly broken into lumps, and placed in well-stoppered bottles. The operation is, at the best, a slow and tedious one, accompanied with an unpleasant smell and some annoyance, as, with the utmost care, explosions cannot be entirely avoided. A steady workman will dissolve up, working with one dish, about 1½ lb. of sodium per day, but he could be trained to take charge of two dishes.

Preparation of Dilute Phosphoric Acid.—Introduce into a French glass tubulated retort, of capacity of forty-two parts, twelve parts of water and two parts of phosphorus. Place the retort on a sand bath, and introduce through a funnel tube, fixed in the tubulure by means of a cork and reaching half an inch below the level of the liquid, eight parts of nitric acid. Apply gentle heat, and watch the operation closely as soon as reaction commences. When the reaction slackens add more nitric acid in portions of about one-fourth part at a time. Should the reaction become violent, small quantities of warm water must be added until it is reduced to its ordinary action, which may be compared to the gentle boiling of water. The formation of frothy bubbles on the surface of the liquid is always the forerunner of violent reaction, and should be checked at once. I have found that if it was checked at this stage, a comparatively small amount of water would answer, but if allowed to react violently a much larger quantity of water was necessary. The evaporation of the acid, after the phosphorus is all oxidised, is conducted in a porcelain capsule; towards the end of this process it will froth up, owing to the rapid disengagement of nitric oxide. The dish must therefore have about three times the capacity of the acid when concentrated, and a little distilled water should be kept conveniently near, to add in case there is danger of frothing over. It is scarcely necessary to add that the operation should be conducted under a good furnace hood, or otherwise the beak of the retort should be introduced into a good flue.—*C. L. Diehl, Am. Pharm. Assoc.*

Meetings for the Week.

Wednesday, June 19.

Geological Society, 8 p.m. Mr. S. V. Wood, jun., "*On the Post-Glacial Structure of the Thames Valley;*" Dr. Duncan and Mr. J. Thomson "*On Cyclocyathus;*" Mr. J. W. Salter "*On the Tracks of Pteraspis in the Upper Ludlow Sandstone;*" Rev. J. H. Timins "*On the Chemical Geology of the Malvern Hills;*" Mr. T. M. Hall "*On the Fossils of the North Devon Series;*" Mr. W. R. Swan "*On the Geology of Princess Islands, Sea of Marmora;*" Dr. Collingwood "*On the Sulphur Springs of Formosa;*" Mr. G. B. Stacey "*On the Geology of Benghazi, Barbary;*" Dr. Haast "*On the Geology of Canterbury, New Zealand;*" Dr. Dawson "*On a New Carboniferous Mollusk;*" Mr. E. Thornton "*On the Coal of Brazil.*"

Thursday, June 20.

Royal Society, 8½ p.m.
Chemical Society, 8 p.m.

Friday, June 21.

Royal Institution, 8 p.m. Professor Tyndall "*On some Effects of Sonorous Vibration.*"

Determination of Arsenic in Sulphide of Arsenic.—To determine the arsenic contained in sulphide of arsenic—an operation often necessary for the estimation of arsenic—M. Graebe uses a standard solution of iodine, as in the estimation of arsenious acid. Suspend the sulphide of arsenic in water, add some carbonate of soda, then a little starch paste, and the standard solution of iodine. (It is evidently necessary that the sulphide of arsenic should be freed from sulphuretted hydrogen.) The reaction takes place according to the equation—

$$AsS_3 + 5I + 5HO = AsO_5 + 5HI + 3S.$$

—*Journal für praktische Chemie*, xcvi. 261.

Volumetric Estimation of Lead and Tin.—M. Graeger determines the lead by ferrocyanide of potassium; the decomposition takes place according to the equation—

$$2(PbO,NO_5) + 2(KCy),FeCy = 2(PbCy),FeCy + 2KO,NO_5.$$

Ferrocyanide of lead is almost insoluble in acids, and its precipitation is easy. The author employs a standard solution of ferrocyanide of potassium; when all the lead is precipitated, the liquid colours ferric salts blue, which may be tested in one drop of it. An excess of ferrocyanide may be added, and determined in the filtered liquid by permanganate of potash. As a control, the ferrocyanide of lead may be suspended in water, and titrated by permanganate. Tin, in the state of bichloride, may be estimated in the same way, but not when in the state of protochloride; in that case it must be first changed to bichloride.—*Journal für praktische Chemie*, xcvi. 330.

SUPPLEMENT TO THE CHEMICAL NEWS.

Friday, June 14, 1867.

SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Separation of Tin and Arsenic, by Professor WÖHLER.

THIS method is based upon the solubility of sulphide of arsenic in bisulphite of potash, which does not dissolve sulphide of tin. The mass, oxidised by nitric acid, is allowed to digest with sulphur and caustic potash till solution is complete (or till the formation of a metallic oxysulphide, which is separated by filtration). The liquid, treated by excess of sulphurous acid, is allowed to rest for some time, and is then evaporated till two-thirds of the water and all the sulphurous acid have gone off. Filter off the sulphide of tin, and wash it, not with water, which must not be used here, but with a concentrated solution of chloride of sodium. This may be removed from the precipitate by means of a slightly acid solution of acetate of ammonia, but the liquor so obtained must not be added to the washing waters charged with salt. The sulphide of tin, when dried, may be converted into oxide of tin by roasting in contact with air. The arsenic which the liquid contains in the state of arsenious acid may be precipitated by a current of sulphuretted hydrogen.

Chemical Composition of the Mud from the Streets of the City of London, by Dr. LETHEBY.*

DURING the last twelve months many analyses have been made in my laboratory of the mud from the City thoroughfares, with the view of ascertaining the relative proportions of horsedung to the matter from the abraded stones and iron of wheels and horseshoes; and the results show that the former material averages about 57 per cent. of the dried mud.

It was first ascertained that the amount of moisture in the street mud varies to a considerable extent, according to the state of the weather, but it is rarely less than 35·3 per cent. of the weight of the mud in the driest weather—the average of ordinary weather being 48·5 per cent.—and in wet weather it ranges from 70 to 90 per cent.

After all moisture has been driven off from the mud by exposing it for many hours to a temperature of from 266° to 300° of Fahrenheit, the relative proportions of organic and mineral matters were as follows; and for comparison the composition of well-dried fresh horse-dung and common farmyard dung has also been determined:—

Composition of Mud from the Stone-paved Streets of the City, compared with fresh Horsedung and Farmyard Dung dried at 300° Fahr.

Constituents.	Fresh Horse-dung.	Farm-yard Dung.	Mud from Stone-pavod Streets.		
			Maximum Organic.	Minimum Organic.	Average.
Organic matter .	82·7	69·9	58·2	20·5	47·2
Mineral matter .	17·3	30·1	41·8	79·5	52·8
	100·0	100·0	100·0	100·0	100·0

* Communicated by the author.

The largest amount of mineral matter is always found in the mud in wet weather, when the abrasion of the stone and iron is greatest. At that time it may amount to 79 per cent. of the weight of the dry mud; whereas, in dry weather, it does not exceed 42 per cent. Taking the average of all weathers, the amount of horsedung to abraded matters is about 57 per cent.

The exact proportions of stony and ferruginous matters in the mineral constituents of the mud have not been determined; but from the deep red colour of the ash obtained by incinerating the mud, there can be no doubt that the proportion of iron in the mud is very large; and it must have been derived from the wheels and horseshoes abraded by the stones.

In the case of the wood pavement, the amount of organic matter in the dried mud was larger than in the case of the stone pavement. It amounted, in fact, to about 60 per cent., and the ash was highly ferruginous.

Very probably the average proportions of horsedung, abraded stones, and abraded iron in the mud from the stone-paved thoroughfares is about as follows:—

Horsedung	57
Abraded stone	30
Abraded iron	13
	100

The mud was in every case so finely comminuted that it floated freely away in a stream of water, and the inference is that it would not subside to any great extent in a sewer with a moderate flow of water.

On the Invariableness between the Ratios of the Weights of the Elements forming Chemical Compounds, by J. S. STAS.

I HAVE already stated that the laws of chemical proportions are not mathematically proved. Indeed, the attentive examination of all the facts in the science bearing upon this subject has convinced me that chemists rely rather upon the constancy of the composition of compounds, than upon a rigorous demonstration of Wenzel's law, and of Dalton's hypothesis, known as the *law of multiple proportions.*

I shall not here examine Gay-Lussac's celebrated article "*On the Mutual Combinations of Gases,*" * nor Wollaston's article "*Upon the Carbonates and the Oxalates,*"† which, since the commencement of this century, have served as the experimental basis of Dalton's hypothesis. It is now allowable to affirm *à priori* that Gay-Lussac has not succeeded in proving his *law of volume* as a mathematical law; for, in fact, it can only be correct within certain limits, since the law of the compressibility of elastic fluids and the law of the expansion of gases by heat are themselves only approximately correct. The experiments of Wollaston on the relations of oxalic acid and potash in the neutral and acid oxalates were performed upon such a small scale that it is impossible to tell from them if the law of multiple proportions is a mathematical or an approximate law. Even admitting the quantities to have been sufficient, the principle relied on by the famous English chemist—viz., *neutrality measured by colouring matter*—

* *Mémoires de Physique et de Chimie de la Société d'Arcueil*, vol. ii. p. 207.
† *Philosophical Transactions of the Royal Society*, 1808, 1st part, p. 96.

is but an hypothesis whose basis requires *à priori* proof.

All the analyses and syntheses yet performed are quite powerless to prove the law of definite proportions to be a mathematical law. For, whatever skill a chemist may possess, it is impossible for him to perform an analysis or synthesis without committing an error of observation. Now, hitherto, nothing has proved that the differences found in certain analyses between experiment and calculation must be *wholly* owing to error in the operation; a certain part may be due to the inexactitude of the law of definite proportions. Then, again, if the existing analyses and syntheses could give an exact solution of this problem, all chemists would agree as to the atomic weights of a large number of bodies, and Prout's hypothesis would be definitely decided. The diversity which has long existed as to certain atomic weights proves better than any reasoning that an absolute proof of the law of definite proportions is still wanting.

The constancy of the composition of stable compounds being admitted, what is required to resolve this problem? It must be proved that in binary and ternary bodies, for example, having each *two elements in common*, the common elements exist with *invariably the same ratios as to weight*. Thus in two bodies, AB and ABC, the ratios of the weights of A to B should be just the same in AB as in ABC.

It may be seen that the solution of this problem may be made independently of analysis, for to resolve the problem it is merely required to discover if the ternary bodies may be reduced to binary bodies without any fraction, however small, of either of the common elements becoming free; or, inversely, if the binary may be transformed into ternary substances without any fraction of one of the elements of the binary compound remaining unincluded in the ternary compound.

Among all the facts composing the science of chemistry, there is not one which entirely satisfies these conditions. The transformation of the chlorate and bromate of potassium into the chloride and bromide under the influence of heat is the nearest approach of any. Chemists who have closely studied this decomposition of the chlorate have observed traces of chlorine only in the disengaged oxygen. In the analysis that M. Marignac made of this salt, he attempted to measure these traces of chlorine.‡

For my part I have tried every means for fixing the chlorine on red-hot silver.§

In the hope of finding in the transformation of chlorate and bromate of potassium into chloride and bromide a solution of the problem in question, I made new and lengthy trials, but they were all fruitless. I always found traces of chlorine or bromine, although I had taken every conceivable precaution to deprive the chlorate and bromate of the infinitesimal quantities of silica or of foreign metals which they retain with the most persistent tenacity. I was not more fortunate with the perchlorate of potassium; however slowly I decomposed it by heat, and whatever pains I took to purify it, the oxygen it gave off by the action of heat was always, towards the last, contaminated by traces of chlorine.

Having failed in these attempts, I directed my researches in another direction. It is well known that sulphurous anhydride transforms into iodide of silver the iodate of that metal suspended in water, at the same time that it becomes sulphuric acid. I have shown that, under the same influence, bromate becomes bromide, and chlorate chloride, of silver. The absolute insolubility of iodide, bromide, and chloride of silver in water acidulated with sulphuric acid, and the possibility of recognising in a liquid a ten-millionth part of silver, of iodine, of bromine, or of chlorine, are exceptionally favourable conditions for submitting the law of definite proportions to a decisive test. For this purpose I undertook the researches I am about to describe.

These experiments were very difficult of execution. There were two obstacles I had to contend with; the first, which is readily foreseen, consists in the great difficulty of procuring salts of silver sufficiently pure to be submitted to so rigorous a test; the other, which was quite unforeseen, is due to the property possessed by sulphurous acid of changing under the influence of still obscure, or rather completely unknown, causes, and of having, in its changed condition, peculiarities opposed to those which it possessed before undergoing this change.

It is of course impossible for me to give here any idea of the difficulties I met with in the preparation of *pure iodate, bromate, and chlorate of silver;* they were naturally different for each of the salts. As the different steps which I took will prove very instructive to those who would care to repeat these researches, I will relate very fully the means to which I had recourse to obtain these salts, and to ascertain their degree of purity.

‡ *Bibliothèque Universelle de Genève*, vol. xl. p. 148.

§ *Recherches sur les Rapports Réciproques des Poids Atomiques: "Analysis of Chlorate of Potash."*

CORRESPONDENCE.

Chemistry in Schools.

To the Editor of the Chemical News.

Sir,—Having now for three years made chemistry a regular and important part of my pupils' studies, I am able to speak most favourably of the general results of my experiment. At first I feared the boys would neglect their other work for the sake of this most fascinating subject, and that I should detect a falling off in their mathematics, or Latin, or history, or what not. My fear was entirely groundless. They have not learnt less of languages, but more of science. Boys who before had no idea of study for its own sake have been tempted to apply themselves, of their own accord, to chemistry, and, with the earnestness which this pursuit has put into them, have worked all the better at their other lessons. Of course they take more interest in the experiments than in the explanations. But even this characteristic of boys' nature has its good side. They are not liable to value theories more than facts; and in course of time they learn to *ask* for explanations, and are not content till they get them. Chemistry teaches habits of careful observation, patience, caution, neat-handedness, and quickness. It stimulates ingenuity, and strengthens the faculty of generalisation. The other day I found that one of the boys had for months been colouring his maps with prussian blue of his own manufacture, having got it, by an obvious method, out of the red marl which abounds in this district. He dissolved the peroxide of iron with sulphuric acid, and precipitated his prussian blue with ferrocyanide of potassium. Without enlarging upon the topic of my letter further, I very strongly recommend those of my fellow-teachers who have not yet thoroughly tried the experiment, to introduce chemistry forthwith into their school-course; only it must be taught *well*—as accurately and as fully as the Latin or the mathematics. I am convinced that the most exact of the experimental sciences, lying at the basis of so many other departments of inquiry, must form an indispensable part of a judicious and philosophical scheme of education.

I am, &c. E. S.

Nottingham, June 6th, 1867.

The Tricks of Trade.

To the Editor of the Chemical News.

Sir,—Will you permit me to call public attention to a system which is undermining the chemical manufactures of the United Kingdom, and which, if not checked, will drive these important branches of industry, for which we possess such eminent natural facilities, more and more into foreign countries?

The evil to which I refer is that organised system of bribery and corruption prevailing in the sale of drugs and chemicals, such at least as are used in the cotton, woollen, and silk trades for dyeing, printing, bleaching, &c. Suppose, *e.g.*, that a traveller calls at a dyeworks and obtains an order. He immediately sends a message to the foreman who is to use the article, requesting an interview. The parties meet at some out-of-the-way public-house, and after a little general conversation over a glass of brandy, business begins. Says the traveller, "I've just seen your governor and got a trial order for a dozen bottles of 'double muriate,' and if you will give it a good character we will make it a snug thing for you." The foreman, putting on an air of complete indifference, asserts that he is very well satisfied with the article he has in use, but is, of course, not averse to anything really better. At length, after much bargaining and more brandy, it is agreed that, in consideration of a bribe of from 5s. to 10s. per carboy, the new article is to be reported better than the old. A couple of sovereigns are then handed to the foreman as a retaining fee, and the meeting terminates. It must be distinctly understood that if a traveller neglects thus to "make all right" with the foreman, his wares, how excellent soever, will, in most establishments, be condemned. If needful, a quantity of goods will be spoiled by some intentional neglect, and the blame will be laid on "that new lot of bottles."

If a traveller fails to obtain an order, he still seeks out the foreman, and, by dint of cash and promises, attempts to gain him over. "You are using Messrs. N. N's. wares? Well, you can say by opportunity that they have been falling off in quality, and that you have heard ours very highly spoken of. If you can get us in, you shall have so-and-so."

The amount thus given in bribery is enough to startle outsiders. I could point out a foreman dyer who demanded as the price of his goodwill 10s. per carboy on "scarlet finishing spirits," invoiced at 4d. per lb. As the carboys would average 130 lbs. net, this man's modest share of the plunder would amount to 23 per cent. On nitrate and nitro-sulphate of iron the "present quotations" are 1s. to 2s. 6d. per carboy, and on liquid ammonia 1s. to 2s. Solids and pastes, from obvious reasons, do not allow as much "tip" as liquids. Still the amount is in some cases considerable. On extract of indigo the fee averages 2s. 6d. per cwt. On cudbear and archil it is also heavy. I could name a foreman who received 14*l.* for using about $7\frac{1}{2}$ tons of these articles. Other chemicals, such as oil of vitriol, soda-ash, and bleaching powder, are sold honestly when coming direct from the maker, though there are plenty of middlemen who sell these articles, of course duly adulterated, on the bribery system. I have never yet met with an authenticated case of "tip" being given on the aniline colours.

But to get in at an extensive dye or print works, some manufacturing chemists and drysalters will for a time go far beyond the tariff above given, even offering to hand over to the foreman who can manage the "job" the entire profits on all transactions for the first two or three months. A pattern-dyer, about to obtain a position in a first-rate establishment, holds a perfect *levee* of travellers and agents, and literally sells his future employer to the highest bidder. Nor is this all: the drysalter is expected to treat the foreman-dyer whenever they meet, to lend him a trap for an airing on Sundays, and to assist him if out of work or in trouble. Some firms give, yearly or quarterly, a dinner or supper to all foremen who patronise their wares. In one town there was established a so-called "dyers' club," ostensibly for discussing trade mysteries. It struck the public as suspicious that the traveller of one particular manufacturing chemist was unremitting in persuading dyers to attend the convivial meetings of the "club," and that this same chemist, or some representative of his, invariably occupied the chair on these occasions.

I must mention that, though foremen-dyers take a leading part in this system, yet the plunder is in many establishments shared by clerks, warehousemen, pattern-designers, and, in short, by any one who has contrived to gain a share of influence, and has opportunities of "ear-wigging" the master. Sometimes even one member of a firm is found accessible to bribery, and will, for so much per cask or per carboy, connive at the robbery of his partners and of himself.

Transactions of this nature sometimes come to light in an amusing manner. A young man who had represented an eminent drysaltery firm lately left them, and accepted a different employment in the same district. One day he received from his late principal a letter to this effect:—"We are forwarding a sample chest to Messrs. ———. As a large order is pending upon it, will you oblige by seeing their dyer, whom you know? Tell him that the chest is marked ———, and that if he will speak well of it we will make it a good thing for him. Please not to mention the matter to our present agent, as we are cutting the job too fine to allow him his commission." Another traveller offered the head dyer at a certain establishment 2s. 6d. per cwt. on a cask of extract of ———, for which he had just taken an order. The dyer, who had a share in the concern, at once mentioned this in the office; and when in due course the traveller called for the account, the amount, less 2s. 6d. per cwt., was paid him, with the intimation that any future visits would be useless.

Two makers, A. and B., had been in the habit of supplying "blue iron" to a certain dyeworks. A new head dyer who had been appointed declared himself unable to use A.'s, which he stated to be deficient in bloom. One day he sought up A., and said to him, "If you will give me 1s. 6d. per bottle, as B. does, I will give your blue iron a good character." A. not only refused, but told the man's employers, who, when B. called, informed him that they could only continue to do business with him on condition that he would supply them with the same quality of iron at 1s. 6d. per bottle less, to which, after a little bargaining, he consented.

The first result of the system is to encourage adulteration and other phases of commercial dishonesty. The object of the bribe-giver is to make the very poorest article which will pass muster. He therefore dilutes his liquid preparations with water as far as practicable, and, to keep up the specific gravity, adds matters more or less prejudicial. The weight of packages is often deficient. A dyer, bargaining with a traveller for an increase of "tip," has been known to say, "Empties are never tared at our shop, so you can write your tare three or four pounds lighter than it really is, keeping the gross right, and give me the price of what that will save you." The following ingenious scheme was practised for some time successfully by a manufacturing chemist:—The tops of his carboys were covered with several pounds of loose damp straw and rubbish, the tare being represented as lighter, and the net weight as heavier, than was the fact. The bottles being weighed, the gross was found correct, and they were passed on to the dye-house. In pouring out the contents of the bottles, this wet thatch fell off, and the empties, when returned to be tared, were found quite correct. A chemist has been known, among a dozen bottles of "red cotton spirits" and oxalo-chloride of tin, to send one or two bottles filled with water, and distinguished by a mark known to the dyer, who poured the contents down the sink and coolly fetched another bottle. The same dyer

was in the habit of regularly wasting his mordants and colours in order that a fresh supply and a new bribe might be the result. He also, with the connivance of the gate-keeper, sent back bottles when only half empty. The chemist then filled them up and sold them afresh. By such means consumers are robbed of the money which is to corrupt their servants.

Another result of the system is the discouragement of invention and improvement. Success does not turn upon the question who can make preparations yielding at the cheapest rate the brightest, fastest, evenest, and solidest colours, but simply upon this—Who can and will go farthest in the career of bribery and corruption?—a contest in which a Runge, a Hofmann, or a Perkin would inevitably be beaten by less scrupulous persons. You may make better mordants than ——, the old-established bribers. It is of no avail. The dyer will shake his head and say that he "can't get his colour" with your preparations. Nor is the case altered if you bring forward something entirely new. Your invention may save time and labour, and may give a better result, but the general question head dyers will ask is simply—How will it affect our perquisites? and unless this can be satisfactorily answered you will be "wet-blanketed" to your heart's content. Novelties like the aniline colours, of course, take the trade by storm; but many improvements, valuable if less striking, never get a fair trial. Thus invention is driven to seek elsewhere that scope which is denied at home.

Further, when a master dyer discovers how he is being robbed, he very naturally grows jealous, and, as far as possible, procures his requisites from foreign makers.

It may, perhaps, be objected that a dyer must get his colour, and, if so, that he cannot use really bad articles. I reply that a colour may be generally got in various ways, but that it is commercially essential to get it in the cheapest and quickest manner, and in the one which interferes least with the strength, durability, and suppleness of the fibre. There is also a wide margin between a colour which barely passes muster and one which is pronounced equal to the very best in the market. The bribe-loving dyer does not aim at excellence; his attention is sufficiently occupied with producing a passable result with the rubbish which his tempter puts in his hands.

The tinctorial trades of England are evidently not progressing as they ought. It is painful to see woollen mills running night and day to produce "sale yarns"—*i.e.*, yarns which, instead of being dyed in this country, are exported uncoloured.

With your kind permission I will on a future occasion point out how the bribe-givers and bribe-takers may, to a great extent, be baffled. I am, &c. W.

[The statements in this letter are so well authenticated by the writer that we feel bound to give them insertion. At the same time we must express our conviction, in justice to many honourable firms, that such practices as above described are the exception rather than the rule. —Ed. C. N.]

NOTES AND QUERIES.

Letters are waiting at our office for S. Johnson; F. K.; F. G. H.

Sodium.—Sir,—If any one can give me a hint as to the best means of preserving sodium, I shall be greatly obliged.—N. Tyne.

Packing for Pumps for Corrosive Liquids.—Sir,—If one of your numerous correspondents would tell me what sort of packing I could use for a chemical pump, he would confer a great boon upon me. I want it for a plunger pump to lift chloride of lime liquid. Yarn is eaten away in a few days. Vulcanised india-rubber is not affected by the "bleach," but there is a difficulty in screwing it tight.—M. James.

Carbon Biscuits.—Sir,—I cannot tell your correspondent "Sheff." how to make carbon biscuits, but I can strongly recommend highly carbonised bread as equally efficacious. Doubtless this mixed with flour an water would make good charcoal biscuits.

Dyeing Fancy Leather.—Sir,—If your correspondent, E. Church, will refer to O'Neill's "Chemistry of Calico Printing," or to the Dictionary of Calico Printing and Dyeing by the same author, he will find a great deal of very useful information on this subject. Hunt's edition of Ure's Dictionary of Arts, article "Leather," also contains much that he will find useful.

Chinese Blue.—"Learner," St. Helen's, Lancashire, wishes to know the composition of Chinese blue. It is one of the synonyms of "prussian blue," which is also called indifferently Paris, Berlin, and mineral blue. Full practical account in Watts's Dict., art. "Pruss. Blue," also under head "Ferricyanides," p. 245, subheading "Potassio-Ferrous Ferricyanide."

Repairing Looking-glass.—Sir,—J. Thompson will find that the plan he speaks of will repair the bare place; but there will generally be a mark at the outer circumference of the pool of mercury. I strongly advise him to scrape all the amalgam off, and deposit a coating of pure silver on the glass. By following Browning's excellent directions (quoted in your last volume), he will be able to do this in a few hours. —A. Milo.

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor, and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

*** In publishing letters from our Correspondents we do not thereby adopt the views of the writers. Our intention to give both sides of a question will frequently oblige us to publish opinions with which we do not agree.

Vol. XIV. of the Chemical News, containing a copious Index, is now ready, price 11s. 0d., by post, 11s. 6d., handsomely bound in cloth, gold-lettered. The cases for binding may be obtained at our Office, price 1s. 6d. Subscribers may have their copies bound for 2s. 6d. if sent to our Office, or, if accompanied by a cloth case, for 1s. Vols. I., II., and VII. are out of print. All the others are kept in stock. Vol. XV. commenced January 4, and will be complete in 26 numbers.

Q.—Spelter is the commercial name for zinc.

F. Stephens.—Artificial ivory for billiard balls has been made from a mixture of paper pulp, sulphate of baryta, and gelatine. They are said to be quite equal to ivory balls.

C. L.—Apply to Mr. Sutton, Eastern Counties Laboratory, Norwich. He will supply you with all the requisites for volumetric analysis.

Amateur.—It was obviously an oversight. "Une Amie" did not send name and address. Can "Amateur" supply it?

Dr. Adriani wishes us to state that his last letter was forwarded, together with a former letter on the same subject, and was intended as a private communication. That being the case, Dr. Adriani should have given some intimation that his letter was not intended for publication.

A. B. C.—1. Amongst aqueous solutions having powerful affinity for oxygen, you may find the following useful:—A solution of pyrogallic acid in potash; an ammoniacal solution of subchloride of copper; a mixture of potash and solution of ferrous sulphate. You may, perhaps, find it useful to absorb oxygen by shaking together copper turnings and very dilute sulphuric acid. 2. The mixture explodes rather violently, and has more than once occasioned serious injury. 3. In taking photographs of the spectrum, we did not find that the point of maximum intensity of deposit was in the slightest degree influenced by the base of the bromide, iodide, &c., used in conjunction with the silver salt.

Communications have been received from Rev. E. Smith; Dr. Odling; Johnson and Matthey (with enclosure); the Assistant General Secretary to the British Association; Dr. Gladstone; F. Field; F. O. Ward; S. Mellor; Dr. R. Angus Smith (with enclosure); W Schofield; J. Levincke; H. Walker; Dr. Letheby; H. Hofman; S. Baker; A. Watt; W. Millward; J. C. Todd; H. Henderson; E. Rothwell; Dr Miller; John Bray, F.C.S.; Geological Society; H. H. Watson (with enclosure); Dr. Anjohn (with enclosure); Ritchie and Co.; Savory and Moore; Sir Henry James; Mr. Worthen; McDougall and Co.; Henry Hall; Sir B. C. Brodie, Bart.

Books Received.—"The Mixture-book;" "Germinal Matter and the Contact Theory;" by James Morris, M.D. Lond.; "Journal of Materia Medica," No. 5.

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SCIENTIFIC AND ANALYTICAL CHEMISTRY.

On the Microscopical Examination of Coal Ash or Dust from the Flue of a Furnace, by J. B. Dancer, *F.R.A.S.**

When coal is burnt in a furnace to which atmospheric air has free access, a portion is converted into gaseous and volatile matter; and the incombustible substance which remains is the ash. The amount of ash in coals from different localities is very variable; it is said to range from 1 to 35 per cent. The ash or dust which is the subject of this paper was collected from the flue of my steam boiler furnace, in which common engine coal is used as fuel. This coal leaves a considerable amount of incombustible matter. A specimen of the dust is now before you; it is of a reddish-brown colour, and free from soot or carbonaceous particles.† When this dust is examined under the microscope with a power of 40 or 50 diameters, it is found to consist of ferruginous matter and crystallised substances, some particles transparent, others white and red. It contains also a number of curious-looking objects, which vary considerably in size and colour; the majority of these bodies are spherical, and when separated from the irregularly shaped particles forming the bulk of the dust they become interesting objects for the microscope. I shall confine my remarks more especially to these globular bodies. Some of these are as perfect in form as the most carefully turned billiard balls, and have a brilliant polish. The various colours which these globules exhibit give additional interest to their examination. Some are transparent crystal spheres, others are opaque white, many are yellow and brown, and variegated like polished agates or carnelian of different shades. The most abundant of the highly polished balls are black; there are others which look like rusty cannon balls—some of these have an aperture in them like a bombshell, and many are perforated in all directions. To obtain these objects the dust should be washed in a bowl and all the lightest particles allowed to float away; the remainder consists of fragmentary crystalline and ferruginous substances; mixed with these are the polished balls described, which, under the microscope, by a brilliant reflected light, look like little gems. To separate the spherical bodies from the irregular ones, it is only necessary to sprinkle some of this material on an inclined glass plate, and by gentle vibration the balls roll down, and can thus be collected. Having satisfied ourselves with the examination under the microscope, it is natural that we should desire to know more about these novel objects. What is their elementary constitution? Why are they spherical? How do they get into the flue? I have not attempted a chemical analysis of these minute bodies, many of which are less than the 100th part of an inch in diameter. I can only therefore offer an opinion as to their probable constitution, judging from what is known of the chemical analysis of coal ash, and from the appearance they present under the microscope. Referring to the chemical analysis of coal ash, we find that it sometimes contains silica, magnesia, alumina, sesquioxide of iron, lime, soda, potash, sulphate of calcium, anhydrous sulphuric acid, annydrous phosphoric acid, sulphur, and sometimes traces of copper and lead. The vegetable origin of coal is now generally admitted, and doubtless some of the substances I have just named have been taken up by the coal plants, whilst other portions may have collected in the locality where the coal was formed. As this is not immediately connected with our present inquiry, I proceed to speculate as to the constitution of these globular bodies. The transparent spheres I imagine to be silicates of soda or potash; the opaque white are most likely silicate of soda or potash combined with lime and alumina; the yellow and brown are silicates coloured by iron in different proportions. The black globes are not all alike in composition; some of these are silicates coloured by carbon, others are iron balls coated externally with a silicate. Many of these rusty cannon balls are probably ferrous oxide formed by the action of heat on the iron pyrites in the coal. There are also balls of black magnetic oxide; the perforated shells are probably ferrous sulphides. The globular form of these bodies suggests that they have been thrown off in scintillations, such as are seen during the combustion of iron in oxygen gas, and whilst in a fluid state they assume a spheroidal form. They are carried by the draught into the flue, and being of greater specific gravity than the carbonaceous matter forming the smoke, they fall before the current of air has reached the chimney. Some of the dust has been a considerable time in the flue, exposed to the intensely heated circulating flame; the reducing action of this would probably convert some of the oxide into metallic iron. Many of these balls have the appearance of reduced oxides. The flue dust contains a larger amount of ferruginous matter than can be accounted for by the analysis of coal ash. I think the surplus may be regarded as representing the wear and tear of the iron work about the furnace, such as fire bars, boiler plates, &c. The brick work and cement about the boiler and flues may also supply some of the silica, alumina, and iron for these balls, numbers of which are merely thin shells. The movements of these objects, caused by the approach of a magnet under the stage of the microscope, are somewhat amusing, and it is at times startling to see the crystalline objects, both spherical and irregular, exhibit magnetic attraction; probably they contain particles of iron imbedded in them; if they do not, may we not imagine that there is some magnetic compound in which the crystalline matter predominates? When we consider the accidental condition under which this matter has combined, it is just possible that some new molecular arrangement or combination of elements may have taken place. It is very probable that many of these polished balls are much more complex in their elementary constitution than I have stated. They are, in fact, a kind of glass, and many of them merely bulbs. Pelouze states that glass is probably an indefinite mixture of definite silicates. Glass, containing small quantities of ferrous oxides and sodic sulphates, when exposed to sunlight, becomes yellow, and possibly some of these balls may have changed in colour since they came from the flue. Hydrochloric and nitric acid exert very little action on the ferruginous globes; this may be due in some measure to the high temperature at which the oxides have been formed; in other cases they are no doubt protected by an external coating of some silicate. It would require much time and patience to collect a sufficient number of each kind of these minute objects for a chemical analysis; but the spectroscope might probably assist in revealing their constitution. When time permits I hope to resume the subject.

*

* Read before the Manchester Literary and Philosophical Society.

† My attention was drawn to this subject by Mr. Johnson, of Wigan, in November, 1866.

On the Supposed Nature of Air prior to the Discovery of Oxygen, by GEORGE FARRER RODWELL, *F.C.S.*

(*Continued from vol.* XIV. *page* 53.)

XVI. J. C. Sturm. — John Christopher Sturm,* although not very notable in the science of pneumatics as an original investigator, did much to propagate the discoveries of others, and to induce pneumatical research. He has been called "*le restaurateur des sciences physiques en Allemagne*," but we cannot admit this designation, both on account of the inaccuracy of the expression, and because it behoves us to remember that Otto von Guericke, Gaspar Schottus, and Athanasius Kircher, were among his contemporaries, and with him assisted in the introduction of a taste for physical science into Germany. In regard to the inaccuracy of the above expression, we may remark that the term "*restaurateur* des sciences physiques" is incapable of being applied to any individual of the period in which Sturm lived. A *restorer* is one who brings back, or induces the return of, that which existed at some former time, but the physical sciences had no pre-existence, and therefore could not be restored. We may speak of "the restoration of learning," and of the "Renaissance period of literature," because we know that among the Greeks and Romans a noble and polite literature had arisen at a long prior period, and had been sustained by some of the most sovereign intellects which the world has beheld. We may speak of Petrarch as the restorer of *belles-lettres*, and of Cosmo de' Medici and Marsilio Ficino as the restorers of a taste for the Platonic philosophy, because an elegant and refined erudition and a love for the Platonic philosophy had pre-existed, and had for a time been extinguished. But this was not the case with physical science; it had no Renaissance period. In the age of Sturm it was new born into the world; hence he cannot be called its *restaurateur* in Germany, but may rather be regarded as an indefatigable and assiduous nurse, who helped to rear the young child, and to give it a good start in life.

We have no wish to depreciate Sturm, but rather to show that he is not entitled to the extravagant praise which one of his biographers (who probably committed this error of judgment "quoniam dilexit multum") awards to him. We do not think that the services of Sturm have ever been sufficiently recognised by the world at large, although they were undoubtedly well recognised in his own country during his lifetime, and in the succeeding period. Apinus speaks of him as "hic μαθηματικοτατος et per omnem Europam longe celeberrimus naturalis scientiæ Doctor;"† while Brucker at a somewhat later period designates him as "vir longe doctissimus et tum veteris philosophiæ, tum recentioris callentissimus, quique experientiam naturali philosophiæ optimo consilio junxerat, ut ex ejus Collegio Curioso constat."‡

The "Collegium Curiosum" alluded to in the last sentence was a scientific society founded by Sturm in 1672 on the plan of the Accademia del Cimento. It originally consisted of twenty members, and it continued to flourish long after the death of its founder. The early labours of the society were devoted to the repetition (and often modification) of the most notable experiments of the day, and to the discussion of the results. Two volumes of proceedings were published by Sturm, the first in 1676, and the second in 1685; in them we find a collection of the principal pneumatic experiments of the Florentine academicians, and of Pascal, Boyle, Hooke, Otto von Guericke, and Huygens. The volume, which appeared in 1676, is entitled, "*Collegium Experimentale sive Curiosum. In quo primaria hujus seculi inventa et experimenta physico-mathematica . . . . . per ultimum quadrimestre anni* 1672. *Viginti naturæ scrutatoribus*, &c." The "*Programma Invitatorium*" is dated June 3, 1672; and Sturm therein urges that inasmuch as the age of disputatious philosophy had given way to that of experimental philosophy, and as, moreover, scientific societies had been founded in Florence, London, Paris, Rome, and Venice, it would seem to be desirable to found one in Germany, for the attainment of which end he requests the collaboration of the learned.

The dedication of the work (to Antonio Magliabecchio, Duke of Tuscany) is a good example of the turgid and florid Latinity which prevailed in the dedications both of that and of a much later period. Then follows a list of the members, and a preface by Sturm describing the object and aims of the society, and the first chapter commences with an account of the diving-bell "recens inventa,"§ and described by George Sinclair‖ in his "*Ars Magna et Nova Gravitatis et Levitatis.*" Next follow chapters relating to the camera obscura, the Torricellian experiment, the gravity of air, the water barometer, the mechanical powers, the thermometer, the air-pump, the microscope, the telescope, &c. In the 1685 volume (which is a continuation of the above), Sturm describes a modified form of Boyle's air-pump, which he had invented; but although by its means a partial vacuum was rapidly obtained, a good vacuum was impossible, because a spring was employed to close the valve, which allowed air to pass from the receiver to the pump barrel; but when the air within the receiver was much rarefied, the force exercised by its expansion was incompetent to overcome the pressure of the spring, and the receiver ceased to be further exhausted.

Altogether these two volumes would seem to constitute a nearer approach to a text-book of the very sparse (but rapidly increasing) physics of the period, than any preceding work. In addition to the above Sturm was the author of a large number of works, chiefly mathematical and physical.

Sturm was Professor of Mathematics and Natural Philosophy in the University of Altorff¶ for thirty-four years, and in that capacity possessed, and exercised, considerable influence as a propagandist of the new philosophy. His own studies had been pursued in the

* Born at Rippolstein in Bavaria in 1635, died at Altorff in Franconia in 1703.

† "Vitæ Professorum Philosophiæ qui a condita Academia Altorfina." Norimbergæ, 1728.

‡ "Institutiones Historiæ Philosophicæ." Lipsiæ, 1756.

§ The invention of the diving-bell, is, however, wrongly attributed to Sinclair, for it is mentioned by Bacon in the "Novum Organum," and by the Italian mathematician Nicolas Tartaglia.

‖ At that time Professor of Natural Philosophy in the University of Glasgow.

¶ This must not be confounded with its homonyme, the capital of the Swiss canton of Url, which is a town of greater size, and in the present day of greater importance. The Altorff alluded to above is in Franconia, a few miles distant from, and under the jurisdiction of, Nuremberg. It is mentioned as early as the year 912, and in 1823 contained 1800 inhabitants. The University was founded in 1579, according to Lloyd ("Dictionarium Historicum, Geographicum, et Poeticum," 1686) and Hoffmann ("Lexicon Universale," 1698); and in 1575, according to Scally ("Geographical Dictionary," 1787) and Worcester ("Geogr. Dict.," 1821); but we must accept the latter date, because Apinus ("Vitæ Proff. Phil., &c.") gives the life of a professor who is described as holding office in the University in 1575. Scally in 1787 writes as follows:—"The fine University structure consists of a building three stories high, and contains in it a valuable library, an anatomical theatre, and a chemical elaboratory. In the main body of it is an observatory. . . It now contains about 200 students." In 1809 it was incorporated with the University of Erlangen, and it thus happens that one of the earliest homes of experimental philosophy in Germany has ceased to be recognised or noticed.

Universities of Jena and Leyden, in the former of which the Aristotelian philosophy prevailed, and in the latter the philosophy of Descartes. He commenced his career as a rigid Aristotelian, and afterwards became a syncretist,** and endeavoured to unite the philosophy of Aristotle with that of Descartes, so as to produce a system participating in the dominant qualities of each. In this, however, he failed, and he then abandoned syncretism, and became essentially and completely a Baconian philosopher. In his thirty-seventh year we find him asserting that for a right investigation of nature the philosophy of Aristotle is not to be followed, neither that of Descartes, but the principles of truth and reason founded upon experimental proof.

Sturm was one of the first professors in Europe—"physicam scientiam juxta cum mathematicis publice docere." What a mighty revolution had occurred in this century in regard to the tolerance of individuality of opinion and the dissemination of free philosophical thought! Here we have the Baconian philosophy introduced into the very heart of a centre of learning without opposition, and with a simultaneous and necessary subversion of the Aristotelian philosophy. How well this contrasts with the intolerance exhibited by the Universities of Pisa and Padua (always noted for their strong adherence to Aristotle)—an intolerance which drove from the former University its greatest ornament and glory, Galileo!

It is not in the capacity of a great discoverer in science that we have here spoken of Sturm; it is not because he exercised a markedly direct influence either upon pneumatics or pneumatic chemistry; but because, by indirect means, he did much for the furtherance of those branches of science; because he helped to induce a permanent and wide-spreading taste for physical science; finally, because he laboured long and lovingly, and in the true spirit of the Baconian philosophy.

The University which he adorned—"ubi mathesin et physicam summa cum laude et applausu docuit"—has passed away, and with it the memory of the man. It would seem to be forgotten that he established in the heart of Europe a centre for the propagation of experimental philosophy; it would seem to be forgotten how deeply he stamped his name upon the times in which he lived, and how great has been the after-influence:—the letters are all but obliterated, and it has become necessary to grave them more deeply before they quite disappear.

TECHNICAL CHEMISTRY.

*Note on the Bituminous Schists of Vagnas (Ardèche).** *by M.* L. Simonin.

This bed of schist, now worked, merits notice. It is more a sort of tertiary boghead than a true schist. Its texture is compact and massive, like that of carbonised and compressed peat. Its origin from peat is further revealed by the numerous very delicate vegetable filaments apparent to the naked eye in the rock.

The schist, distilled in a revolving retort, gives about 10 per cent. by volume of raw paraffin oil. This oil is decarburetted in a fixed retort, and gives, with a lighter oil, a very pure coke as residue. The tar is separated from the decarburetted oil by means of sulphuric acid and soda, and it furnishes an oil that is purified by a second distillation and a new treatment with acid and alkali. The result is a white opalescent light oil, of a specific gravity of 0·825°, and an agreeable ethereal odour. The illuminating power is that of nine ordinary wax candles, and the point of combustion is 158° F., whereas the American oil inflames at 113° F.

The yield of light oil is 5 per cent. of distilled schist, and the secondary products are the coke above mentioned, the acid tars, paraffin, &c. The distilled schist serves as a combustible for all the operations of the manufactory; also, for the same purpose, the lignites, too poor to be distilled into mineral oil, are made use of.

** From *συγκρίνω*, to conjoin, cement together, applied to those who endeavour to unite the opinions of diverse sects into one system, and thus to produce a comprehensive coalition system, and a consequent coalition of sects. Brucker has well observed—"Parum utilitatis attulisse philosophiæ hoc syncretismi studium, res ipsa et eventus loquitur. Frustra enim philosophiæ veræ auctoritas hominis aut sectæ præfigitur, quæ non, quis dixerit, vel quid dixerint philosophorum principes, quærit, nec curat, utrum eorum effata saluari queant, sed quid verum sit meditatione duce inquirit."

* Communicated by the author.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, June 18, 1867.

The Society of Mechanical Engineers of England held its annual meeting in Paris a few days ago, presided over by Mr. Penn, the celebrated constructor of marine engines. The meetings took place in the amphitheatre of the Conservatoire des Arts et Métiers, and many papers were read and communications made by the members. Amongst others were—"*Puddling by Machinery*," by M. Menelaus; "*Ventilation of Buildings*," by General Morin; "*The Flowing of Solid Bodies through Orifices*," by M. Tresca, &c. Without presenting any novelty, the subjects brought forward were listened to with much interest. The scientific congress terminated with a magnificent banquet, at which 200 persons sat down. The meeting took place in the magnificent saloon of the Restaurant des Frères Provinciaux. Among the French celebrities invited we may mention General A. Morin, M. Leverrier, M. Combe, M. Solacroup, director of the Orleans railways, M. Tresca, &c. Mr. Penn proposed, in the handsomest terms, the health of General Morin, Messrs. Tresca, Fairbairn, and Stewart, of Manchester, and dwelt on the cordiality existing between the mechanical engineers of France and England.

M. Pasteur continues actively his researches on silkworms. He is now able to state that—1. Not a single silkworm, chrysalis, or moth derived from the eggs exempt from corpuscles presented any of these microscopic organisms; out of 16 sets of eggs laid, not infected with corpuscles, 15 succeeded. 2. The silkworms, chrysalides, and moths from the eggs obtained from corpusculous moths gave, in a more or less degree, the worms, chrysalides, or moths affected with corpuscles. M. Pasteur has also discovered in his researches another terrible malady, which he carefully describes, and for which the only remedy seems to be the renewing of the air by a shaft. M. Le Ricque de Monchy has found from his observations that creosote preserves healthy silkworms from parasitic diseases, and cures sick ones.

In submitting to the action of the poles of an electromagnet, bubbles of the glycerine liquid of M. Pasteur, filled with oxygen, M. Chantard, of Nancy, has succeeded in obtaining energetic attractions, and considerable oscillatory movements. He produces a sort of magnetic pendulum, which can be rendered visible to all by a ray of Drummond light.

The lectures at the great hall in the park of the Champ de Mars commenced last week. They will be continued daily—at midday, 2 p.m., 4 p.m., and 8 p.m.—on different subjects, at the same time exhibiting and explaining various objects in the palace. For this purpose special authority has been granted by the Imperial Commission for the temporary

removal of objects from the stalls to the lecture hall in the park. Excursions will also be made, accompanied by the audience, to visit and explain important objects in the main building, park, and reserved garden. The lectures at noon embrace subjects only indirectly connected with the Exhibition, such as lectures on the universal language of music invented by M. Sudre; studies on India, by M. Giguel, &c. From 2 to 5.30 p.m. the attention of the audience will be directed to various objects, and at 4 p.m. the subject is confined to those in direct relation with the Exhibition. Among the scientific lectures will be one by Dr. Crace Calvert on phenic acid and other analogous products. The new building is situated at the right of the Pont de Jena, next to the International Club building on the banks of the Seine. It holds 500 persons, and the decorations are carried out in the style and with the well-known taste of Parisian ornamentation. The electric light, the Carlevaris, Drummond, oxyhydro lamp (magnesia), and the millegazo lamp will alternately light up the interior of the hall. F. Moigno.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

The Glass Company of St. Gobain, Chauny, and Cirez, have four plate glassworks and two manufactures of chemical products.

The factories at Saint Gobain and Chauny are the oldest of those belonging to the Company. Their creation dates as far back as 1693. They comprise all the workshops, furnaces, and apparatus necessary for the manufacture of mirror and plate glass, thin white or coloured glass for dwellings, and thick slabs for lighting cellars. They also furnish moulded glass of a special quality for lenticular lighthouses, the cutting and polishing of which is executed in the workshops of MM. Henri Lepaute, Sautter, Barbier, and Fenestre.

The great lenses, which serve for enlarging photographic views in the apparatus of Worthly and others, are made at St. Gobain, as was also the great piece of glass 3 ft. 11¼ in. in diameter for the great silvered mirror of M. Leon Foucault's telescope.

The glass plates, &c., cast at St. Gobain are sent to Chauny, nine miles off, to be polished, silvered, &c. At these immense works the motive power for grinding and polishing is 600 horse-power, partly furnished by a fall of water, and partly by steam. The polishing powders, such as emery, English red, &c., are there prepared. The manufacture of tinfoil for silvering glass is also carried on at Chauny, whence are supplied all the mirror factories of the Company. They make sheets of tinfoil of dimensions almost without limit, either by hammering and rolling, or by casting on cloth.

The establishment at Cirez-sur-Vezouze replaced in 1740 the factory of Saint Quirin, and includes the workshops and melting furnaces, a portion being situated near falls of water, which are utilised as motive power. The plate glass factory at Stolberg was founded in 1853 by the Aix-la-Chapelle Company. An establishment was founded by the Company at Manheim in 1854, at the confluence of the river Neckar with the Rhone.

Amongst the objects exhibited by the Company are—

1. Plate glass, unsilvered, measuring 5·93 m. by 3·64 m., or 21·58 square metres in superficies, and 5·88 m. by 3·60 m., or 21·17 square metres.
2. Silvered mirrors, 5·90 m. by 3·68 m., surface 21·71 square metres; 5·01 m. by 3·60 m. = 18·04 square metres.
3. Moulded rough glass.
4. Coloured and aventurine glass, the latter being very beautiful.
5. Thin glass for small mirrors and photographic plates.
6. Different products, including a leaf of tinfoil, 6 m. by 4 m., for silvering the largest glasses.

There are also eight fine specimens of different sorts from the other works mentioned above, owned by the Company. The glass for the immense plates described above, was melted in one single pot, capable of containing a ton of matters in fusion, 700 to 800 kilogrammes being utilised.

The silvering of these gigantic glass plates is one of the most delicate operations. For those of twenty square metres, the sheet tin weighs two pounds per square metre; if it is any thinner, it dissolves the mercury before the operation is finished.

For a long time past I have abstained from discussing the chemical and pharmaceutical products of England, for my heart always failed me, as it was with pain that I viewed the inferiority of the English display in this class. I cannot help regretting their abstinence from our galleries, either from indifference or from other causes. This inferiority, perhaps, may be explained by the bad light in which the objects are placed, so that the daylight hardly penetrates except in a triste and gloomy ray. Several English chemists, well informed of all that has been accomplished latterly, accompanied us to this department, and found almost nothing of novelty.

The Chemical News has announced that one of its oldest and most qualified collaborateurs is coming to Paris to examine the English section, and bring to light the hidden articles. I warmly applaud this step.

I am now able to give you the following list of those to whom the great prizes of the Exhibition have been awarded :—

2nd Group.—MM. *Maine*, printer and publisher at Tours; *Garnier*, photographic engraving, Paris; *Sax*, wind instruments, Paris; *Mathieu*, surgical instruments, Italy; the Reverend Father *Secchi*, meteorologic apparatus, Rome; *Eichens*, astronomical instruments, Paris; *Jacobi*, galvano-plastic work, Russia.

3rd Group.—*Fourdinois*, art furniture, Paris; *The Baccarat Company*, for crystal glass, France; *Klagmann*, sculptor, Paris.

4th Group.—*The City of Lyons*, tissues and silk goods.

5th Group.—*Petin, Gaudet, and Co.*, steel, France; *Bessemer*, manufacture of steel, England; *Hofmann*, colours obtained from coal-tar, Berlin (Prussia); *Krupp*, steel works, Essen (Prussia); *Brazil*, *Algeria*, *British India*, *Egypt*, *Italy*, and the *Ottoman Empire*, for cotton since 1861.

6th Group. — *Creusot Company*, different machines, steam engines, &c., France; *Siemens*, gas furnaces, Berlin (Prussia); *Whitworth*, mechanical tools, England; *Viguier*, railway signals, France; *Cyrus Field*, Transatlantic cable, New York (United States); *Hughes*, telegraphic apparatus; *Isthmus of Suez Company*; *Kindt* and *Chaudron*, apparatus for tubbing mine shafts and sounding apparatus, Belgium; *Hofmann*, brick ovens; *Napier*, marine steam engines, Glasgow; *John Penn*, marine engines, Greenwich; *Hirn*, transmission of motive power, France; *Farcot*, steam engines, Saint Omer (France).

7th Group.—*M. Pasteur*, member of the Institute, preservation of wines, France; *Henri Mares*, application of sulphur to vines; *The Emperor of Russia*, thorough-bred horses.

10th Group.—*The Emperor of the French*, workmen's dwellings; *Dufresne*, mercury gilding, France.

F. Moigno.

The Supposed Lunar Volcano.—Mr. Rutherford, on the other side of the Atlantic, has lately examined all his photographs of the moon (which surpass in size, as well as minuteness of detail, any European pictures), with especial reference to this subject, and he avers that he is unable to detect any change in the brightness of the locality in question.

PROCEEDINGS OF SOCIETIES.

ROYAL INSTITUTION.

Friday, May 31, 1867.

On the Chemistry of the Primeval Earth, by* T. Sterry Hunt, M.A., F.R.S.

The subject of my lecture this evening, as has been announced, is the Chemistry of the Primeval Earth. The natural history of our planet, to which we give the name of geology, is, necessarily, a very complex science, including, as it does, the concrete sciences of mineralogy, of botany, and zoology, and the abstract sciences of chemistry and physics. These latter sustain a necessary, and very important relation, to the whole process of development of our earth from its earliest ages, and we find that the same chemical laws which have presided over its changes, apply also to those of extra-terrestrial matter. Recent investigations show the presence in the sun, and even in the fixed stars—suns of other systems—the same chemical elements as in our own planet. The spectroscope, that marvellous instrument, has, in the hands of modern investigators, thrown new light upon the composition of the farthest bodies of the universe, and has made clear many points which the telescope was impotent to resolve. The results of extra-terrestrial spectroscopic research have lately been set forth in an admirable manner by one of its most successful students, Mr. Huggins. We see by its aid matter in all its stages, and trace the process of condensation and the formation of worlds. It is long since Herschel, the first of his illustrious name, conceived the nebulæ, which his telescope could not resolve, to be the uncondensed matter from which worlds are made. Subsequent astronomers, with more powerful glasses, have been able to show that many of these nebulæ are really groups of stars, and thus a doubt was thrown over the existence in space of nebulous luminous matter: but the spectroscope has now placed the matter beyond doubt. We thus find in the heavens planets, bodies like our earth, shining only by reflected light; suns, self-luminous, radiating light from solid matter; and, moreover, true nebulæ, or masses of luminous gaseous matter. These three forms represent three distinct phases in the condensation of the primeval matter, from which our own and other planetary systems have been formed.

This nebulous matter is conceived to be so intensely heated as to be in the state of true gas or vapour, and, for this reason, feebly luminous when compared with the sun. It would be out of place, on the present occasion, to discuss the detailed results of spectroscopic investigation, or the beautiful and ingenious methods by which modern science has shown the existence in the sun, and in many other luminous bodies in space, of the same chemical elements that are met with in our earth, and even in our own bodies; realising, in a most literal manner, the genial intuition of the poet, who

> "Sees alike in stars and flowers a part
> Of the self-same universal being
> That is throbbing in his mind and heart."

Calculations based on the amount of light and heat radiated from the sun show that the temperature which reigns at its surface is so great that we can hardly form an adequate idea of it. Of the chemical relations of such intensely heated matter modern chemistry has made known to us some curious facts, which help to throw light on the constitution and luminosity of the sun. Heat, under ordinary conditions, is favourable to chemical combination, but a higher temperature reverses all affinities. Thus, the so-called noble metals, gold, silver, mercury, &c., unite with oxygen and other elements; but these compounds are decomposed by heat, and the pure metals are regenerated. A similar reaction was many years since shown by Mr. Grove with regard to water, whose elements—oxygen and hydrogen—when mingled and kindled by flame, or by the electric spark, unite to form water, which, however, at a much higher temperature, is again resolved into its component gases. Hence, if we had these two gases existing in admixture at a very high temperature, cold would actually effect their combination precisely as heat would do if the mixed gases were at the ordinary temperature, and literally it would be found that "frost performs the effect of fire." The recent researches of Henry Ste.-Claire Deville and others go far to show that this breaking up of compounds, or dissociation of elements by intense heat, is a principle of universal application; so that we may suppose that all the elements, which make up the sun or our planet, would, when so intensely heated as to be in that gaseous condition which all matter is capable of assuming, be uncombined—that is to say, would exist together in the condition of what we call chemical elements, whose further dissociation in stellar or nebulous masses may even give us evidence of matter still more elemental than that revealed by the experiments of the laboratory, where we can only conjecture the compound nature of many of the so-called elementary substances.

The sun, then, is to be conceived as an immense mass of intensely heated gaseous and dissociated matter, so condensed, however, that, notwithstanding its excessive temperature, it has a specific gravity not much below that of water; probably offering a condition analogous to that which Cagniard de la Tour observed for volatile bodies when submitted to great pressure at temperatures much above their boiling point. The radiation of heat, going on from the surface of such an intensely heated mass of uncombined gases, will produce a superficial cooling, which will permit the combination of certain elements and the production of solid or liquid particles, which, suspended in the still dissociated vapours, become intensely luminous and form the solar photosphere. The condensed particles, carried down into the intensely heated mass, again meet with a heat of dissociation, so that the process of combination at the surface is incessantly renewed, while the heat of the sun may be supposed to be maintained by the slow condensation of its mass; a diminution by $\frac{1}{10000}$th of its present diameter being sufficient, according to Helmholtz, to maintain the present supply of heat for 21,000 years.

This hypothesis of the nature of the sun and of the luminous process going on at its surface is the one lately put forward by Faye, and, although it has met with opposition, appears to be the one which accords best with our present knowledge of the chemical and physical conditions of matter, such as we must suppose it to exist in the condensing gaseous mass, which, according to the nebular hypothesis, should form the centre of our solar system. Taking this, as we have already done, for granted, it matters little whether we imagine the different planets to have been successively detached as rings during the rotation of the primal mass, as is generally conceived, or whether we admit with Chacornac a process of aggregation, or concretion, operating within the primal nebular mass, resulting in the production of sun and planets. In either case we come to the conclusion that our earth must at one time have been in an intensely heated gaseous condition, such as the sun now presents, self-luminous, and with a process of condensation going on at first at the surface only, until by cooling it must have reached the point where the gaseous centre was exchanged for one of combined and liquefied matter.

Here commences the chemistry of the earth, to the discussion of which the foregoing considerations have been only preliminary. So long as the gaseous condition of the earth lasted, we may suppose the whole mass to have been homogeneous; but when the temperature became so reduced that the existence of chemical compounds at

* Reported specially for this paper, and revised by the author.

the centre became possible, those which were most stable at the elevated temperature then prevailing, would be first formed. Thus, for example, while compounds of oxygen with mercury or even with hydrogen could not exist, oxides of silicon, aluminium, calcium, magnesium, and iron might be formed and condense in a liquid form at the centre of the globe. By progressive cooling, still other elements would be removed from the gaseous mass, which would now become the atmosphere of the non-gaseous nucleus. We may suppose an arrangement of the condensed matters at the centre according to their respective specific gravities, and thus the fact that the density of the earth as a whole is about twice the mean density of the matters which form its solid surface. Metallic or metalloidal compounds of elements grouped differently from any compounds known to us, and far more dense, may exist in the centre of the earth.

The process of combination and cooling having gone on, until those elements which are not volatile in the heat of our ordinary furnaces, were condensed into a liquid form, we may here inquire what would be the result, upon the mass, of a further reduction of temperature. It is generally assumed that in the cooling of a liquid globe of mineral matter, congelation would commence at the surface, as in the case of water; but water offers an exception to most other liquids, inasmuch as it is denser in the liquid than in the solid form. Hence ice floats on water, and freezing water becomes covered with a layer of ice, which protects the liquid below. With most other matters, however, and notably with the various mineral and earthy compounds analogous to those which may be supposed to have formed the fiery-fluid earth, numerous and careful experiments show that the products of solidification are much denser than the liquid mass; so that solidification would have commenced at the centre, whose temperature would thus be the congealing point of these liquid compounds. The important researches of Hopkins and Fairbairn on the influence of pressure in augmenting the melting point of such compounds as contract in solidifying, are to be considered in this connexion.

It is with the superficial portions of the fused mineral mass of the globe that we have now to do, since there is no good reason for supposing that the deeply seated portions have intervened in any direct manner in the production of the rocks which form the superficial crust. This, at the time of its first solidification, presented probably an irregular, diversified surface, from the result of contraction of the congealing mass, which at last formed a liquid bath of no great depth, surrounding the solid nucleus. It is to the composition of this crust that we must now direct our attention, since therein would be found all the elements (with the exception of such as were still in the gaseous form) now met with in the known rocks of the earth. This crust is now everywhere buried beneath its own ruins, and we can only, from chemical considerations, attempt to reconstruct it. If we consider the conditions through which it has passed, and the chemical affinities which must have come into play, we shall see that they are just what would now result if the solid land, sea, and air were made to react upon each other under the influence of intense heat. To the chemist it is at once evident that from this would result the conversion of all carbonates, chlorides, and sulphates into silicates, and the separation of the carbon, chlorine, and sulphur in the form of acid gases, which, with nitrogen, watery vapour, and a probable excess of oxygen, would form the dense primeval atmosphere. The resulting fused mass would contain all the bases as silicates, and must have much resembled in composition certain furnace slags or volcanic glasses. The atmosphere, charged with acid gases which surrounded this primitive rock, must have been of immense density. Under the pressure of such a high barometric column, condensation would take place at a temperature much above the present boiling point of water, and the depressed portions of the half-cooled crust would be flooded with a highly heated solution of hydrochloric acid, whose action in decomposing the silicates is easily intelligible to the chemist. The formation of chlorides of the various bases, and the separation of silica, would go on until the affinities of the acid were satisfied, and there would be a separation of silica taking the form of quartz, and the production of a sea-water holding in solution, besides the chlorides of sodium, calcium, and magnesium, salts of aluminium and other metallic bases. The atmosphere, being thus deprived of its volatile chlorine and sulphur compounds, would approximate to that of our own time, but differ in its greater amount of carbonic acid.

We next enter into the second phase in the action of the atmosphere upon the earth's crust. This, unlike the first, which was subaqueous, or operative only on the portion covered with the precipitated water, is sub-aerial, and consists in the decomposition of the exposed parts of the primitive crust under the influence of the carbonic acid and moisture of the air, which would convert the complex silicate of the crust into a silicate of alumina, or clay, while the separated lime, magnesia, and alkalies, being converted into carbonates, would be carried down into the sea in a state of solution. The first effect of these dissolved carbonates would be to precipitate the dissolved alumina and the heavy metals, after which would result a decomposition of the chloride of calcium of the sea-water, resulting in the production of carbonate of lime or limestone, and chloride of sodium or common salt. This process is one still going on at the earth's surface, slowly breaking down and destroying the hardest rocks, and, aided by mechanical processes, transforming them into clays; although the action, from the comparative rarity of carbonic acid in the atmosphere, is less energetic than in earlier times, when the abundance of this gas and a higher temperature, favoured the chemical decomposition of the rocks. But now, as then, every clod of clay formed from the decay of a crystalline rock corresponded to an equivalent of carbonic acid abstracted from the atmosphere, and equivalents of carbonate of lime and common salt formed from the chloride of calcium of the sea-water.

It is very instructive, in this connexion, to compare the composition of the waters of the modern ocean with that of the sea in ancient times, whose composition we learn from the fossil sea-waters which are still to be found in certain regions, imprisoned in the pores of the older stratified rocks. These are vastly richer in salts of lime and magnesia than those of the present sea, from which have been separated, by chemical processes, all the carbonate of lime of our limestones, with the exception of that derived from the sub-aerial decay of calcareous silicates belonging to the primitive crust.

The gradual removal, in the form of carbonate of lime, of the carbonic acid from the primeval atmosphere, has been connected with great changes in the organic life of the globe. The air was doubtless at first unfit for the respiration of warm-blooded animals, and we find the higher forms of life coming gradually into existence as we approach the present period of a purer air. Calculations lead us to conclude that the amount of carbon thus removed in the form of carbonic acid has been so enormous, that we must suppose the earlier forms of air-breathing animals to have been peculiarly adapted to live in an atmosphere which would probably be too impure to support modern reptilian life. The agency of plants in purifying the primitive atmosphere was long since pointed out by Brongniart, and our great stores of fossil fuel have been derived from the decomposition, by the ancient vegetation, of the excess of carbonic acid of the early atmosphere, which through this agency was exchanged for oxygen gas. In this connexion the vegetation of former periods presents the curious phenomenon of plants, allied to those now growing beneath the tropics, formerly flourishing within the polar circles. Many ingenious hypotheses have been

proposed to account for the warmer climate of earlier times, but are at best unsatisfactory, and it appears to me that the true solution of the problem may be found in the constitution of the early atmosphere, when considered in the light of Dr. Tyndall's beautiful researches on radiant heat. He has found that the presence of a few hundredths of carbonic acid gas in the atmosphere, while offering almost no obstacle to the passage of the solar rays, would suffice to prevent almost entirely the loss by radiation of obscure heat, so that the surface of the land beneath such an atmosphere would become like a vast orchard-house, in which the conditions of climate, necessary to a luxuriant vegetation, would be extended even to the polar regions. This peculiar condition of the early atmosphere cannot fail to have influenced in many other ways the processes going on at the earth's surface. To take a single example: one of the processes by which gypsum may be produced at the earth's surface involves the simultaneous production of carbonate of magnesia. This, being more soluble than the gypsum, is not always now found associated with it, but we have indirect evidence that it was formed, and subsequently carried away, in the case of many gypsum deposits whose thickness indicates a long continuance of the process, under conditions much more perfect and complete than we can attain under our present atmosphere. While studying this reaction I was led to inquire whether the carbonic acid of the earlier periods might not have favoured the formation of gypsum, and I found, by repeating the experiments in an artificial atmosphere impregnated with carbonic acid, that such was really the case. We may thence conclude that the peculiar composition of the primeval atmosphere, was the essential condition under which the great deposits of gypsum, generally associated with magnesian limestones, were formed.

The reactions of the atmosphere which we have considered, would have the effect of breaking down and disintegrating the surface of the primeval globe, covering it everywhere with beds of stratified rock of mechanical or of chemical origin. These would now so deeply cover the partially cooled surface that the amount of heat escaping from below is inconsiderable, although in earlier times it was very much greater, and the increase of temperature met with in descending into the earth must have been many times more rapid than now. The effect of this heat upon the buried sediments would be to soften them, producing new chemical reactions between their elements, and converting them into what are known as crystalline or metamorphic rocks, such as gneiss, greenstone, granite, &c. We are often told that granite is the primitive rock or substratum of the earth, but this is not only unproved, but extremely improbable. As I endeavoured to show in the early part of this lecture, the composition of this primitive rock, now everywhere hidden, must have been very much like that of a slag or lava, and there are excellent chemical reasons for maintaining that granite is in every case a rock of sedimentary origin—that is to say, it is made up of materials which were deposited from water like beds of modern sand and gravel, and includes in its composition quartz, which, so far as we know, can only be generated by aqueous agencies, and at comparatively low temperatures.

The action of heat upon many buried sedimentary rocks, however, not only softens or melts them, but gives rise to a great disengagement of gases, such as carbonic and hydrochloric acids, and sulphur compounds, all results of the reaction of the elements of sedimentary rocks, heated in presence of the water which everywhere filled their pores. In the products thus generated we have a rational explanation of the chemical phenomena of volcanos, which are vents through which these fused rocks and confined gases find their way to the surface of the earth. In some cases, as where there is no disengagement of gases, the fused or half-fused rocks solidify *in situ*, or in rents or fissures in the overlying strata, and constitute eruptive or plutonic rocks like granite and basalt.

This theory of volcanic phenomena was put forward in germ by Sir John F. W. Herschel thirty years since, and, as I have during the past few years endeavoured to show, it is the one most in accordance with what we know both of the chemistry and the physics of the earth. That all volcanic and plutonic phenomena have their seat in the deeply buried and softened zone of sedimentary deposits of the earth, and not in its primitive nucleus, accords with the conclusions already arrived at relative to the solidity of that nucleus; and also with the remarkable mathematical and astronomical deductions of the late Mr. Hopkins, of Cambridge, based upon the phenomena of precession and nutation; those of Archdeacon Pratt; and those of Professor Thompson on the theory of the tides; all of which lead to the same conclusion—namely, that the earth, if not solid to the centre, must have a crust several hundred miles in thickness, which would practically exclude it from any participation in the plutonic phenomena of the earth's surface, except such as would result from its high temperature communicated by conduction to the sedimentary strata reposing upon it.

The old question between the plutonists and the neptunists, which divided the scientific world in the last generation, was, in brief, this—whether fire or water had been the great agent in giving origin and form to the rocks of the earth's crust. While some maintained the direct igneous origin of such rocks as gneiss, mica-schist, and serpentine, and ascribed to fire the filling of metallic veins, others—the neptunian school—were disposed to shut their eyes to the evidences of igneous action on the earth, and even sought to derive all rocks from a primal aqueous magma. In the light of the exposition which I have laid before you this evening, we can, I think, render justice to both of these opposing schools. We have seen how actions dependent on water and acid solutions have operated on the primitive plutonic mass, and how the resulting aqueous sediments, when deeply buried, come again within the domain of fire, to be transformed into crystalline and so-called plutonic or volcanic rocks.

The scheme which I have endeavoured to put before you in the short time allotted, is, as I have endeavoured to show, in strict conformity with known chemical laws and the facts of physical and geological science. Did time permit, I would gladly have attempted to demonstrate at greater length its adaptation to the explanation of the origin of the various classes of rocks, of metallic veins and deposits, of mineral springs, and of gaseous exhalation. I shall not, however, have failed in my object, if, in the hour which we have spent together, I shall have succeeded in showing that chemistry is able to throw a great light upon the history of the formation of our globe, and to explain in a satisfactory manner some of the most difficult problems of geology; and I feel that there is a peculiar fitness in bringing such an exposition before the members of this Royal Institution, which has been for so many years devoted to the study of pure science, and whose glory it is, through the illustrious men who have filled, and those who now fill, its professorial chairs, to have contributed more than any other school in the world to the progress of modern chemistry and physics.

ACADEMY OF SCIENCES.

June 3, 1867.

(From our Special Correspondent.)

M. Debray, aided by M. Wisnegg, described and set to work two apparatus for producing very elevated temperatures by means of common gas mixed with air. The first was that of M. Schlösing, modified by M. Wisnegg, the second that of M. Perrot.

If a certain number of Bunsen burners be united together so as to form one single jet of flame, without, however,

complete incorporation, the heating power is most remarkable, provided a sufficiently energetic and swift draught is given to it. The form of the furnace must also be varied, and the draught regulated, according to circumstances.

With an apparatus burning 70 cubic feet per hour, under a pressure of two or three inches of water, and without any draught but that obtained by a sheet-iron pipe 6½ feet high, M. Debray was able in fifteen minutes to melt 670 grammes (1·48 lb.) of silver. It only takes half an hour at most, when the operation is at full work, to melt and cast a kilogramme of copper into a bar. Lastly, M. Debray melted several specimens of grey and white iron; a pound of a sort of cast-iron which passes for being very difficult to melt was run in thirty minutes, another piece weighing 1½ lb. was melted in an hour or so. During the operation the crucible can be examined in the interior by the aid of a mirror or a bucket of water, which can receive the metal in case of accident.

M. Chevreul announced the melancholy news of the death of our esteemed friend M. Pelouze in a touching letter from his son. He was equally excellent as a father, husband, and practical chemist.

M. Tresca read the third part of his memoir "*On the Flowing of Solid Bodies, especially Metals, through Apertures.*" Pressure exerted on any point of a substance is transmitted throughout the interior of the mass.

M. Hulot, director of the workshops of the manufactory of postage-stamps at the Paris Imperial Mint, made two communications, "*On Aluminium Bronze and Aluminium Soldering.*" The paper, and especially that gummed and dried, as used for postage-stamps, rapidly deteriorates tools even of the best tempered steel. The 300 perforators for piercing the postage-stamps are used up after a day's work, in a few hours their ends becoming blunted, and instead of piercing only crush the paper, the last holes made being considerably enlarged. M. Hulot replaces the steel by aluminium bronze at 10 per cent., and the new tool, striking 126,000 blows per day, or 180,000,000 holes, has worked for several months without need of repairs. Aluminium bronze does not unite freely with solder by the old process; but if we take equal quantities of zinc amalgam and common solder, aluminium bronze can be admirably soldered together by it. This solder becomes better, again, if it is alloyed with once or twice its weight of tin. Thus we have three excellent solders—1st, solder with half its weight of amalgam; 2nd, with a fourth; 3rd, with an eighth. This is an excellent discovery, as it places aluminium on a new footing as regards mechanical appliances, especially for bushes or bearings for machinery, as the metal is almost indestructible by friction.

The Academy then proceeded to the election of a member in the section of medicine and surgery. M. Nélaton was elected, the majority consisting of thirty-two votes against twenty-six given to M. Laugier.

June 10.

M. Schönbein placed a sealed letter in the hands of the Academy, containing a description of an important discovery by M. Liebig.

M. Boussingault communicated a new mode of finding the quantities of lime in analyses. The process consists in precipitating the lime in the state of sulphate, which is decomposed either by a Bunsen gas blowpipe or by one of Schlösing's furnaces, the sulphuric acid being vaporised, and the lime remaining pure. In several experiments on the decomposition of earthy or metallic sulphates, M. Boussingault remarked frequent anomalies, the quantity of the base remaining often being less than it ought to be. This fact is not easy to account for.

M. Payen reproduced in part his communication made to the Society of Encouragement, on the fabrication of paper pulp from wood fibre, and on the transformation of ligneous matters into cellulose and glucose.

MM. de Luca and Ubaldine communicated a "*Note on the Reaction between Sulphurous Acid and Sulphuretted Hydrogen.*" The sulphur which is deposited by the reciprocal action of sulphurous and hydrosulphuric acid consists of two varieties of sulphur, one soluble and the other insoluble in bisulphide of carbon. The relative proportion of these two sulphurs depends upon the conditions under which the operation is made; the quantity of insoluble sulphur is increased when an excess of sulphurous acid is present. The reaction expressed by the formula

$$2HS + SO_2 = 2HO + 3S$$

has its analogy in the reaction between sulphuretted hydrogen and selenious acid

$$2HS + SeO_2 = 2HO + SeS_2,$$

with this difference—that the bisulphide of sulphur $SS_2 = 3S$, &c., is replaced by the bisulphide of selenium SeS_2.

M. de la Rive read the principal conclusions of a memoir "*On the Sources and Phenomena of Atmospheric Electricity,*" but there was nothing new in it.

June 17.

M. Becquerel placed before the eyes of the Academy several specimens of metals reduced and precipitated by capillary action. In order to answer the objection that these phenomena of reduction or precipitation might be attributed to the action of the alkalies of the split glass tube, he employed polished plates of rock crystal applied one against the other so as to leave only a very small interval, and produce coloured rings; he has thus obtained perfect reduction of several metals. The interval between the plates must be varied according to the different metals, and he has obtained by this means the reduction of such metals as cobalt, nickel, copper, gold, &c. For the reduction of gold, for example, the space between the plates must be less than that for copper. When the solution is dilute, there is no further reduction of metal, but a precipitation of oxide.

M. Leverrier communicated the observations made by M. Wolf on the crater of Linnæus in the moon, from May 10 to June 10. His observations confirm those made by M. Rospighi at Rome, and lead to the same conclusion—viz., that it is not proved that there has been any change in this crater for a century.

M. Dumas read, in the name of M. de la Rive, of Geneva, a note upon an apparatus for measuring the different degrees of transparency of the air. According to M. de la Rive, the great transparency of the air before rain is due to the presence, in the air, of a quantity of invisible vapour which renders transparent the numerous germs floating in the air, to whose presence light mists are attributed.

NOTICES OF BOOKS.

Ure's Dictionary of Arts, Manufactures, and Mines. Edited by Robert Hunt, F.R.S., F.S.S. Fifth Edition. Chiefly rewritten and greatly enlarged. 3 vols. Longmans.

A Dictionary of Science, Literature, and Art. Edited by W. T. Brande, D.C.L., F.R.S.L. and E., of Her Majesty's Mint, and Rev. George W. Cox, M.A., late Scholar of Trinity College, Oxford. 3 vols. Longmans.

The new editions of these two well-known dictionaries, each consisting of some 3000 pages, and each dealing largely with chemistry, are now before us, and it behoves us to offer some criticism upon them. Few tasks could be more difficult. We might indeed, with perfect honesty, confine ourselves to general praise, speak of the great difficulties which attend the compilation of such works, and point out the number of admirable articles, and the vast mass of important information which each contains.

But if we approach the work of criticism, and, while bestowing fair praise on their many excellences, endeavour to point out some of their faults of fact and arrangement, we are met by the fear lest, our praise being necessarily vague while our objections must needs be specific, we should end by leaving upon our readers' minds an unfair impression of the true worth of the books. The criticism which employs itself in picking out small errors and blemishes from a substantially good book, arraying them in rows, and parading them before the eyes of the world, is unfair and ungracious, and cannot be atoned for by any amount of indefinite praise. We should be sorry to be betrayed into injustice of this kind, and shall therefore deal as lightly as possibly with minor blemishes, and shall only point out errors of fact when they appear to go hand in hand with faults of method.

Two general objections will, however, suggest themselves to the chemist on his first glance at the new dictionaries—for new they are, to all intents and purposes. One of these, indeed, they share with but too many modern works of reference. Original authorities are not quoted in either book nearly as often, or as fully, as they should be; and this, we fear, will curtail their usefulness to scientific men in a marked manner. To select an illustration at random. Suppose a chemist wishes to "read up" Madder. He turns to Ure, and there finds an excellent article by Dr. Schunck, in which the results of Persoz, Runge, Robiguet, and many other experimenters, besides those of the writer, are duly chronicled; but scarcely in one single instance will he find a direct reference to the memoirs in which those results were first announced. This is hardly fair. The original memoirs are often just what the chemist wishes to get hold of, and he has a right to expect that his dictionary shall help him in what is generally a troublesome and laborious search.

The other objection is a less serious one. We, of course, are not likely to quarrel with editors for putting too much chemistry into their books, but we cannot but think it would have been better to have left to treatises on pure chemistry a good deal that is included in these volumes. Would it not have been better, for instance, in a technological work like Ure, to have omitted such articles as "atoms," "atomic theory," "combining numbers," and "equivalents"? And what possible object can there be in describing such compounds as "hederic acid," "ambreic acid," "chloriodoform," "pittacal," and "anisidine," all of which, and many more as unimportant, are to be found in one or other of the dictionaries? When every line of space is so valuable, the greatest care should be exercised in the selection of matter, and the excision of these irrelevant subjects would have allowed of a fuller treatment of many which now fare badly.

And now, could we but afford the space, we should enter upon a more detailed examination of the works before us. Mr. Robert Hunt, the editor of "Ure," has done his work conscientiously and well, and each of his volumes is crowded with articles of the utmost interest and importance to the practical chemist. We can do no more than give the titles of a few of them. "Coal-gas," an admirable treatise, 60 pages long, by Dr. Frankland; "Bread," by Dr. Normandy; "Bleaching," and "Calico-printing," "Caoutchouc," "Manure," by Dr. Voelcker; "Sugar," by Mr. Fryer; "Candles," "Glass," "Disinfectants," by Dr. Angus Smith; and "Naphtha," by C. Greville Williams, are all elaborate and most valuable articles. Mr. Greville Williams's contributions to the work are numerous and uniformly well written. Dr. Schunck and Dr. Noad have likewise been large contributors, the article "Iron," by the latter, occupying over 80 pages.

The smaller articles, though frequently leaving much to be desired, are on the whole satisfactory. They seem generally to have been compiled with care, and the editor has wisely allotted them a fair proportion of the space at his command, and has not suffered them to be entirely swamped by the more important ones. We are, nevertheless, inclined to believe that they might advantageously have filled an even larger proportion of the book than they do; for the true province of a book like this is to supply knowledge which cannot easily be obtained elsewhere, and important manufactures usually have special treatises devoted to them, whereas the others can only hope to find their places in a work of reference. We have purposely said nothing of some very important sections of the book. The metallurgy alone would form a good-sized manual, and the descriptions of machinery and mechanical processes are probably quite as extensive; but our task would be even more hopeless than it is now, if we attempted to comment on subjects such as these. We leave the book safely to our readers' criticism, convinced that very few chemists will be able to do without it.

"Brande's Dictionary," the republication of which is only just completed, is very different from the preceding work in object and execution. Much of it, of course, deals with subjects with which we have no concern, and upon which we have no right to speak; but as chemistry, naturally enough, occupies a somewhat prominent position in it, we have a fair *locus standi*. We, indeed, almost wish we had not, for the respect which every chemist must feel for the memory of its original editor makes it an unpleasant task to disparage it. But the truth must be told, and although we admit very cheerfully that many valuable chemical articles are to be found in it, it is on the whole a most unsatisfactory epitome of modern chemical knowledge. In regard to theory this is not to be wondered at. No one expected any very cordial recognition of "croquet-ball" atoms, though we might have begged that our teeth might not be set on edge by barbarous and long-exploded definitions, and doctrines coeval with Lavoisier. But we surely have a right to expect accuracy in facts. We do not complain that there are so few formulæ in the book, although the most out-of-the-way compounds are described. We will not quarrel with CH_2 as a representation of marsh-gas, or C_4H_3 for acetyl, and we will only object on the score of convenience to our old friend CS_2 being described as carburet of sulphur! (we only found the compound by chance), but we must assert in the most earnest manner that the atomic weight of chlorine is *not* 36, nor that of iodine 126, nor that of bromine *about* 78. And, moreover, if we concede C_4H_3 as the formula for acetyl, we must refuse our assent to the further proposition that acetamide is "derived from ammonia by the replacement of one equivalent of hydrogen by acetyle. There is, it appears, a species of lead poisoning to which compositors are liable, and which is called "wrist-drop." "It may be cured," we are told, "by soaking the hand in a solution of potassium and eliminating the lead." We do not attempt to deny it; but we anticipate some difficulty in applying the cure.

Principes de Chimie, fondée sur les Théories modernes. Par A. Naquet, Professeur agrégé à la Faculté de Médecine de Paris, &c. 2e édition, considérablement augmentée. Paris: Savy. 1867.

Leçons Elémentaires de Chimie moderne. Par M. Ad. Wurtz, Doyen de la Faculté de Médecine de Paris. Premier fascicule. Paris: Masson. 1867.

Traités Elémentaires de Chimie Médicale. Par Ad. Wurtz. Parts I. et II. Paris: Masson. 1864-5.

M. Naquet's little book, published less than two years ago, has already reached a second edition, and we are glad to find that the author has taken the opportunity of increasing its bulk very considerably. The book is no doubt well known to many of our readers, and we believe that no one who has seen it will hesitate to join in our cordial praise of it. It is a well-written, clear, and succinct account of the leading doctrines of modern

chemistry, and is, in the best sense of the word, an original work. We do not mean that the author has invented a new system of classification, of nomenclature, or of notation, or that he crowds his pages with records of his own discoveries, but simply that every chapter he writes bears the stamp of individual thought—that the facts and theories he describes are presented, not as raw material cut by a compiler's scissors from a hundred different sources, but digested, assimilated, and, so to speak, organised in the brain of an author who takes the trouble to make a thing his own before issuing it to others. The book is too well known to require a detailed description from us, even if we could afford the space for one, and we will content ourselves with glancing at a few of the new additions.*

M. Naquet, wisely, as we think, devotes a hundred pages at the beginning of his book to laws and general principles, thus dissenting from the fashion which appears to have taken root in England of interspersing everything of the kind, theories of atomicity, rules of nomenclature, laws of combination, and the like, among the sections on the history of the elements. Many portions of this introductory matter have been entirely rewritten, and all have received some modification. At page 22 we find an historical sketch of the great "dissociation" controversy, the author finally giving in his adhesion to that remarkably convenient discovery. The section on the atomicity of radicals contains, of course, an account of Kekulé's views very clearly stated. Hofmann's term "quantivalence" is adopted, and is employed as distinct from "atomicity," the atomicity of an element being regarded as invariable, while its quantivalence may be subject to change. We think the author has made a mistake in devoting three pages to the absurd hypothesis of sub-atoms invented to account for the observed variations in atomicity, but we can easily pardon it for the sake of the distinct rejection which is accorded to it. We are disposed to agree heartily with the following passage from M. Naquet: "Quant à nous, ne voulant pas aller au delà des faits, nous admettons que des molécules non saturées existent à l'état de liberté, parce que l'oxyde de carbone et beaucoup d'autres corps en fournissent les preuves, et nous admettons aussi que les radicaux d'atomicité impaire peuvent exister sans se doubler, parce que cela a lieu pour le bioxyde d'azote AzO, et l'hypoazotide AzO_2."†—Page 48.

With respect to two of the gravest difficulties on the new views, the compounds $AgNaCl_2$ and ICl_3, our author rejects Kekulé's hypothesis of "molecular combination," and prefers to regard chlorine and iodine as being triatomic. The wisdom of such an assumption is, however, extremely questionable.

In the section on acids, bases, and salts, the views of Cannizzaro, Wurtz, and Kekulé are described with a clearness which we have never seen surpassed. No student could have the least difficulty in mastering them.

Before leaving the book, we must, however, advert to one or two somewhat important omissions — omissions which surprise us in such a carefully edited manual. In the account of ozone, the fact that when the ozone is absorbed from ozonised oxygen no contraction of volume is observed, is duly noted, and the hypothetical explanation of this fact suggested by Dr. Odling—namely, that the true formula for ozone is O_2O, and that the removal of one atom of oxygen, therefore, leaves the volume unchanged—is likewise given; but the beautiful experimental verification of this hypothesis recently supplied by M. Soret, who succeeded in absorbing the whole molecule of ozone by oil of turpentine, is unaccountably omitted. The other omission is even more important. The author is evidently ignorant of the splendid memoir of H. Kopp on atomic heats, which was published in the *Philosophical Transactions* for 1865. The result is, that he not only assumes the atomic heats of all elements except carbon, boron, and silicon, to be identical; but he makes the grave mistake of deducing the molecular constitution of water from the specific heat of water, instead of from that of ice.

M. Wurtz, two of whose manuals we take this opportunity of noticing, is certainly a most diligent writer. Besides his completed works, he has three books at present in progress. The titles of two of them are given at the head of this article, while the third, a large dictionary of chemistry, is announced for speedy publication. Of the *Chimie Médicale* two parts have already appeared, one devoted to inorganic, the other to organic chemistry. The third, on "Chimie Biologique," has been expected for some time. As far as it has gone, it is a very good and practical work. Its title, however, hardly gives a true idea of it, for it is simply a manual of chemistry, well written, and arranged in a clear though somewhat old-fashioned manner. The only thing peculiar about it is that all subjects especially interesting to medical men, such as mineral waters, substances used in pharmacy, the detection of poisons, and the like, are brought into marked prominence, and are treated in great detail. Strange to say, the old equivalents are employed throughout. The author apologises for it in his preface, by alleging the necessity of conforming to the official teaching of Paris; but HO, in a work by M. Wurtz, seems almost as much out of place as an account of phlogiston would be.

Only one part of the *Leçons* has as yet reached us, and it is not of a character to call for any particular remark. It is simple, clear, and concise; but though the new atomic weights are adopted in it, it lacks the original and scientific arrangement which distinguishes M. Naquet's *Principes*. In spite of some advantages, we cannot but regard it as far inferior to the last-named work.

* We are glad to hear that a translation of the new edition is in progress, and will be published before long.

† Nitric peroxide has been shown to dissociate below 70° C., and Dr. Frankland (Lecture Notes, p. 61) tries to get over the NO difficulty by regarding it as N_2O_2 dissociated at a very low temperature. But if this were the case it could only dissociate into NO and NO, and the obnoxious compound must, therefore, at ordinary temperatures, contain diatomic nitrogen.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Comptes Rendus. April 8, 1867.

A. Secchi "*On a Spectroscope for Celestial Observations.*"—A. Wurtz "*On the Transformation of Aromatic Carbides into Phenols.*"—A. Kekulé "*On some Derivatives of Benzol.*"—Marié-Davy "*On the Electro-motive Force of Voltaic Batteries.*"—P. Christofle and H. Bouilhet: "*Observations on Dufresne's Memoir on a Process for Gilding and Silvering by Amalgamation without Danger to the Workmen.*"—E. Duchemin "*On the Use of Picric Acid in Voltaic Batteries.*"—Berthelot "*On a Method of Reducing and Saturating Organic Compounds with Hydrogen.*"—Dubrunfaut "*On the Presence and Formation of Crystallisable Sugar in the Tubers of the Jerusalem Artichoke.*"

Poggendorff's Annalen. March 15, 1867.

G. Magnus "*On the Influence of the Adhesion of Vapour in Experiments on the Absorption of Heat.*"—E. Voit "*On the Diffusion of Liquids.*"—E. Zettnow: "*Contributions to the Knowledge of Wolfram and its Compounds;*" "*On a new Method of Qualitative Analysis, in which Sulphuretted Hydrogen and Sulphide of Ammonium are dispensed with.*"—R. Weber "*On the Theory of the Manufacture of Sulphuric Acid.*"—W. Holtz "*On the Construction of Induction Machines for obtaining Electricity of High Tension.*"—R. Schneider: "*Remarks on Von Sommaruga's Memoir on the Equivalents of Nickel and Cobalt.*"—A. Brio "*On the*

Crystalline Form and Optical Properties of Formiate of Cadmium and Baryta."

Annalen d r Chemie und Pharmacie. March, 1867.

R. Bunsen "*On a Method of Estimating the Specific Gravity of Vapours and Gases.*"—M. von Pettenkofer and K. Voit "*On the Quantity of Carbonic Acid given out, and the Oxygen consumed, by the Human Subject during Waking and Sleeping.*"—W. Schlebusch "*On the Chlorinated Substitution Products of Fatty Acids.*"—H. Hlasiwetz and A. Grabowski "*On Carminic Acid.*"—G. Malin "*On a Derivative of Rufigallic Acid.*"—A. Geschier "*On Sulphide of Copper and Ammonium.*"—W. Heintz "*On the Action of Carbonate of Ammonia on Chloracetic Ether.*"—R. Otto and H. Ostrop "*On Benzo-sulphurous Acid.*"

Romberg's Zeitschrift für praktische Baukunst. Nos. 1-3. 1867.

Brad "*On a Method of Testing the Capability of Natural and Artificial Stone for Resisting Frost and Wet.*"—Schmook "*On the Impregnation of Wood with Preservative Solutions.*"—Suvern: "*A Method of Purifying the Waste Waters of Sugar and other Manufactories.*"

Journal des Fabricants de Papier. March 1, 1867.

E. Bourdilliat "*On Testing the Chemical Products used in Paper-making.*"

NOTICES OF PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W. C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

1272. P. Salmon, Westminster, Middlesex, "Improvements in the manufacture of gas, and in apparatus for holding the same."—Petition recorded May 2, 1867.

1345. W. E. Newton, Chancery Lane, "Improvements in explosive compounds, and in the means of igniting the same." A communication from A. Nobel, Rue St. Sebastien, Paris.—May 7, 1867.

1408. G. A. Neumeyer, Döbitz, Prussia, "Improvements in gunpowder for mining purposes."

1409. J. G. N. Alleyne, Alfreton, Derbyshire, "Improvements in puddling furnaces, also applicable to other furnaces of similar construction."

1411. G. Lunge, Ph.D., South Shields, Durham, "Improvements in the preparation of ores, metals, and other substances for working in furnaces."

1416. W. E. de Bourran, Rue Hustin, Bordeaux, France, "Improvements in evaporators for concentrating saccharine fluids."—May 13, 1867.

1464. W. R. Lake, Southampton Buildings, Chancery Lane, "Improvements in the manufacture of white lead." A communication from T. M. Fell and A. G. Fell, New York, U.S.A.—May 17, 1867.

1472. T. Richardson, Newcastle-on-Tyne, "Improvements in the extraction of oils from vegetable substances."—May 18, 1867.

Notices to Proceed.

131. J. G. Franklin, Broadway, Somersetshire, "Improvements in tanning."

133. W. Weldon, Park Villa, West Hill, Highgate, Middlesex, "Improvements in the manufacture of chlorine, and in the production of artificial oxides of manganese for employment both in that and other manufactures."

134. W. Weldon, Park Villa, West Hill, Highgate, Middlesex, "An improved method of manufacturing chlorine."—Petitions recorded January 18, 1867.

148. G. L. Loversidge, Greenfield, Saddleworth, Yorkshire, "Improvements in the tanning of hides and skins, and in the apparatus employed therein."

152. J. Rowley, Camberwell, Surrey, "An improved process for hardening, bleaching, and sweetening crude paraffin."—January 21, 1867.

172. H. A. Bonneville, Rue du Mont Thabor, Paris, "A new and improved process of treating skins in order to separate therefrom the hair and wool, and in the preparation of the hair for the manufacture of hats." A communication from A. Frayssé, Junior, Rue Croix-des-Petits-Champs, Paris.—January 23, 1867.

285. W. E. Newton, Chancery Lane, "An improved process for obtaining metals from their ores." A communication from J. N. Wyckoff, Brooklyn, New York, U.S.A.—February 1, 1867.

379. W. Clark, Chancery Lane, "Improvements in preserving animal or vegetable matters, whether fluid or solid, in a wholesome and edible condition, without material loss or change of their natural flavour." A communication from L. H. Spear, Braintree, Orange, Vermont, U.S.A.—February 9, 1867.

684. H. A. Bonneville, Rue du Mont Thabor, Paris, "A new and improved means of preserving solutions of certain plants and matters in a concentrated state." A communication from C. d'Estains, Rue de Chaillot, Paris.—March 11, 1867.

1151. S. V. Lee, Macclesfield, Cheshire, and C. E. Lankester, Peckham, Surrey, "Improvements in the manufacture of colours and the extraction of colouring and dyeing matters from coal oil, shale oil, or coal tar, combined with peat or turf, and for a combination of any of these substances, and also for the utilisation of the residue for the purpose of what is known as moulders' blacking, after the colouring and dyeing matters have been extracted."—April 20, 1867.

1295. J. Heaton, Langley Mill, Derbyshire, "Improvements in the conversion of cast iron into wrought iron, part of which improvements is also applicable to the conversion of cast iron into steel."—May 3, 1867.

CORRESPONDENCE.

Manufacture of Bisulphide of Carbon.

To the Editor of the Chemical News.

Sir,—On looking over the article on the French Exhibition, in your last week's number, I was surprised to find that the writer had given M. Deiss, of Paris, the merit of being the first to introduce the manufacture of bisulphide of carbon on a large scale and at a low price for manufacturing purposes.

This is a mistake, and an injustice to myself, and for the sake of truth in the history of a new manufacture I beg to inform you that I took out my first patent in England, June 27, 1843, for the application of bisulphide of carbon as a solvent of india-rubber and other gums, and also as a solvent of phosphorus in connexion with some improvements in electro-metallurgy. Shortly before the date of this patent, all the sulphide of carbon I could procure either in England or Germany for my experiments was only six or seven ounces, costing sixty shillings per pound, and even for this I had to wait nearly six months. On applying to an eminent manufacturing chemist in London for help in the manufacture of bisulphide of carbon on a large scale, I was politely informed that I must be mad to expect that a hundredweight could be made, as the danger of preparing it would be fatal to any one making the attempt.

Being fully convinced of the very valuable properties of bisulphide of carbon for commercial purposes, I put up apparatus to prove that it could be produced in a large way and at a trifling cost, and complet ly succeeded.

In justice to a gentleman, Mr. Jesse Fisher, Madeley, Salop, whom I then employed to manufacture it on a large scale for Messrs. Elkington and Mason, who were

interested in my patent, I would observe that under my instruction he erected the necessary apparatus, and in the year 1844 made many tons weight at a cost of one shilling per pound, and very soon afterwards he was able to produce it at threepence per pound; and that gentleman has continued the manufacture in England ever since. My object in furnishing this information is to show that, long before M. Deiss gave his attention to the subject, I had succeeded in making a large commercial manufacture of bisulphide of carbon, and I was also the first to introduce it for manufacturing purposes. And, in fact, before M. Deiss commenced his operations in the manufacture of this article, it had been made by the ton at threepence per pound, and it was not used at all in France until the introduction of my patent for improvements in treating india-rubber in that country; from which you will see that it was in the year 1844 that I made it a success, and not, as stated in the article in the Chemical News, 1848.

I am, &c. Alexander Parkes.

Birmingham, May 28.

Manufacture of Sulphuric Acid.

To the Editor of the Chemical News.

Sir,—In No. 392 of your journal I notice a letter on this subject. Amongst other matters, the writer states that "it is quite possible to obtain a colourless acid at 66° Beaumé from Huelva pyrites." I was not aware that there was any difficulty in preparing an acid, colourless and pretty pure, from this class of pyrites. With regard to the fluxing of the pyrites, I can say that carelessness has as much to do with this irregularity as wrong construction of the burners. A want of proper attention on the part of the burner-men in breaking up the sulphur ore, and managing a regular and sufficient supply of air, is a most frequent cause of fluxing; in ninety-nine cases out of a hundred this is the sole cause. Then we have the complaint of the small quantity of acid got from chambers which have been constructed to produce a far larger amount than is ever obtained from them; in many cases the cause of this proceeds from the too slow combustion of the sulphur ore; a greater part of the pyrites may be "dead out" or only half ignited, generally proceeding from the want of a proper supply of air.

Again, the steam may not be admitted into the chamber in a satisfactory way. This matter is much overlooked. Some makers admit the steam at stated intervals. Now this is wrong; the admittance of steam should be continuous and at a proper pressure. We often hear of the acid doing serious damage to the platinum stills, and the cause is often overlooked for a length of time; this is more particularly the case where the proprietor has no scientific supervision. At last it is discovered that the cause of the damage proceeds from the presence of oxide of nitrogen in the acid. It is well known that acid so contaminated has the property of attacking platinum. The most important part of the process is frequently left in the hands of the burner-men, and left entirely to them as to how the manufacture shall be conducted. In some cases this plan may work well, when the men happen to be intelligent, but in many cases the men are lamentably ignorant. This mostly arises from the fact that no trouble is taken by the manager or chemist to explain to the men in simple language the various processes connected with their work. This is seldom the case; the men go mechanically about their work, and so long as things happen to go right no further interest is taken, but let anything out of the ordinary course occur, and the men are at sea.

However unimportant what I have said may appear, I have always found it to my interest to have the men as well-informed as possible. Carlessness and inattention to trivial matters often lead to the downfall of many operations in manufacturing chemistry.

In your "Suggestion to Manufacturers and Inventors" you make a very good remark respecting the difficulties which often beset the manufacturer, and which might easily be overcome by a short investigation by some competent chemist, "and in many cases a difficulty which appears insuperable to the manufacturer would prove a mere bagatelle to the chemist." Your ideas coincide with mine, but I know many manufacturers who object to a scientific man having access to their works. I can say, however, that such supervision is much needed by them.

I am, &c. J. H. Swindells.

Cure for Dry Rot in Houses.

To the Editor of the Chemical News.

Sir,—It may be of interest to many of your readers, whose houses are infested with dry rot, to learn that a perfect cure, or rather a way of preventing it, has been found out in the alkali works at Saaran, in Silesia. The dry rot is caused by the spores of a fungus (*Merulius lacrymans*), which may be carried away by currents of air, but are mostly contained in the soil. If any soil containing them be used for filling the spaces between the joists and boarding of a chamber-floor, the appearance of dry rot in the house need not create any surprise. A little of such earthy matter may easily be mixed among the sand or slag, if such is used for filling those spaces, or even among the sand which forms part of the mortar. Of course dry rot will not set in if the timber is kept completely dry; but it is well known that this condition is often not easily achieved. A radical remedy against dry rot is, however, found, if the space underneath the flooring boards be filled with a mass capable of destroying vegetable life without doing any injury to the timber or brickwork. No doubt many such compositions might be found, but the builders would be deterred by any considerable expense from using them. Now, on the Saaran alkali works it has been observed (as the manager, Mr. Junker, reports in the *Breslauer Gewerbeblatt*) that tankwaste, that great nuisance of alkali works, is an excellent remedy against dry rot. If some of it is used along with the rubbish for filling the spaces between the joists, and if the whole is beaten down into a mass, it hardens very well, like ordinary tank-waste floors, and it never allows any dry rot to spring up. It makes no difference whether the air has access or not; there is also no smell whatever exhaled. Besides many other striking illustrations of the efficacy of tank-waste in this respect, Mr. Junker mentions a case where two adjoining souterrains had been boarded, the one with, the other (by mistake) without, the application of tank-waste. The latter room was at once infested with dry rot; the former remained quite sound. The boards of the infected room were then taken up again, and tank-waste was applied; since that time (two years and a half) no dry rot whatever has set in, and the decay of the boards, half-rotten as these had already become, was stopped altogether.

None of your readers need be told that tank-waste may be had at all alkali works for the carting away.

I am, &c. G. Lunge.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Hydrocarbons, Solid, from Coal-tar. Fritzsche (C=6).—The hydrocarbon $C_{28}H_{10}$, investigated by Anderson, and considered by that chemist to be the anthracene of Dumas and Laurent, the author believes to have been a mixture of the pure $C_{28}H_{10}$ with other hydrocarbons of lower melting points. The melting point given by Anderson is 180° C., by Dumas and Laurent 213° C., by Fritzsche (five years ago) 210° C.

The author has now succeeded in obtaining this body in a state of perfect purity, and, though unable as yet to give an exhaustive comparison of its properties with those of

the accompanying hydrocarbons of coal-tar, he has established some characteristic reactions, which will suffice for their identification.

The body $C_{28}H_{10}$ separates from its solutions usually in thin, flat crystals, which are never twisted and always of a definite shape. The best mode of observing this is to dissolve a small quantity in a drop of ether on a glass plate; on evaporation a spot is left which appears transparent, but under the microscope is seen to consist of a mass of crystals which, especially along the edge, are well-formed hexagonal plates. The transparency and crystalline structure of the spot are peculiar to this body, which, by that means, can be distinguished from another closely related to it. This latter body dissolves more readily in ether, and leaves a spot less transparent, showing a crumpled appearance at the edges. The spot produced by a mixture of the two is white, perfectly opaque, and with the rim as before.

On cooling an alcoholic solution of the body $C_{28}H_{10}$, flat leaf-shaped crystals, either hexagonal or rhombic, appear, which grow on the sides of the vessel. The other body, under these conditions, forms a voluminous mass of thin twisted plates, which remain suspended in the liquid. A mixture of the two always shows the latter mode of crystallisation. It is then, however, easily seen, with a magnifying glass, that the crystals are not homogeneous.

The method employed by the author for the separation and purification of the body $C_{28}H_{10}$ consists in dissolving the raw material in coal-tar naphtha, redissolving again the first portions that are separated from the solution, and repeating this process several times, until the above-described characteristic phenomenon of crystallisation is observed. To free the body from a yellowish colour, caused by an admixture of chrysogene, its hot solution in coal-tar naphtha is exposed to direct sunlight. On cooling the bleached liquid, large crystals of the pure material are obtained. It is well to treat them finally with a boiling alcoholic solution of picric acid, which removes any admixture of a body of much higher melting-point.

The melting-point of the pure body $C_{28}H_{10}$ the author has never found higher than 207° C.

The behaviour of this body towards light is very remarkable. If a cold saturated solution of it is exposed to direct sunlight, microscopic crystals soon appear, varying in shape according to the nature of the solvent—elongated hexagonal plates from coal-tar naphtha, four-sided rhombic ones from alcohol. These crystals differ greatly from the mother substance. They are almost insoluble in any solvent, and are altogether very indifferent; but if they are melted (a higher temperature being required than for $C_{28}H_{10}$) they are converted again into the original body $C_{28}H_{10}$.

The action of nitric acid on $C_{28}H_{10}$ gives rise to a number of other compounds. The mode of operating was as follows:—The powdered substance was mixed with glacial acetic acid, and nitric acid added drop by drop. The liquid assumes a yellow colour, and, if heat be avoided, a clear dark yellow solution is obtained. On addition of water a resinous precipitate is formed; if the liquid is allowed to stand, evolution of gas gradually sets in, and crystalline bodies are precipitated. If it is heated to 50°—60° C., red vapours are given off, and crystals separate. Of these various derivatives the author describes three:—

1. A colourless body, soluble in alcohol and benzol, which separates from the latter in monoclinometric crystals; is decomposed by continued boiling with acetic acid; forms a precipitate, which combines with picric acid, on adding a basic substance to its alcoholic solution.

2. Large, colourless, prismatic crystals. An alkali added to their solution in alcohol colours the liquid dark orange, and an acid is formed, the potassic salt of which crystallises in red needles. A current of ammonia passed through its benzolic solution produces a dark red amorphous precipitate.

3. A body endowed with the property of combining with nearly all solid hydrocarbons from coal-tar as well as with retene and idrialine. The body is obtained in microscopic crystals, sparingly soluble in most solvents, but soluble to some extent in benzol.

This new nitro-body combines with $C_{28}H_{10}$, forming beautiful large violet crystals of the rhombic system. If they are heated to 170°—180° C., the body $C_{28}H_{10}$ is volatilised, and the nitro-compound remains behind. They also decompose on being dissolved in benzol, the nitro-compound crystallising first; or if treated with acetic or nitric acid, in which case the hydrocarbon is extracted.

Besides the body $C_{28}H_{10}$, the author has obtained from coal-tar three others (α, β, γ) melting at about 190° C., one (δ) melting at about 235° C., and another (ϵ) at about 100° C. Neither of them, however, has been obtained pure. They all combine with the new nitro-compound, which combination furnishes the chief means of distinguishing them from each other.

α, the body already alluded to as resembling closely $C_{28}H_{10}$, gives with the nitro-compound a dark red-brown substance, much less soluble than that produced by $C_{28}H_{10}$. Like the latter, it is converted, on exposure to light, into a "para-" compound.

β forms with the nitro-compound a dark green product.

γ, an orange-coloured, insoluble compound, crystallising from benzol in needles. This body is insoluble even in hot concentrated sulphuric acid.—(*Bull. Acad. Imp. Petersb.* vii.)

Toluol- and Benzol-sulphurous Acid.—R. Otto (C=12, O=16). Toluolsulphurous acid, heated with water to 150° C. in sealed tubes, splits up into toluolsulphuric acid and a body of the composition C_7H_8SO, according to the following equation:—

$$2C_7H_8SO_2 = C_7H_8SO_3 + C_7H_8SO.$$

The new body is not acid, is insoluble in water, readily soluble in hot alcohol, from which it separates in rhombic crystals. Zinc and sulphuric acid convert it into meta-benzylsulphhydrate.

The decomposition of benzolsulphurous acid takes place in a similar manner.—(*Zeitschr. Chem.*, N. F., iii. 262.)

Acids with Water at High Temperatures.—W. Markownikoff and Th. v. Purgold (C=12, O=16). Citric acid, when heated with water in sealed tubes to 160° C., splits up into carbonic anhydride and itaconic acid, according to the following equation:—

$$C_3H_4(HO)\begin{Bmatrix} CO.OH \\ CO.OH \\ CO.OH \end{Bmatrix} = C_3H_4\begin{Bmatrix} CO.OH \\ CO.OH \end{Bmatrix} + CO_2 + H_2O.$$

Similar reactions are obtained with tartaric, quinic, lactic, anisic acid, and some substitution-compounds of benzoic acid.—(*Zeitschr. Chem.*, N. F., iii. 264.)

MISCELLANEOUS.

Larkin's Magnesium Powder Lamp.—It is a singular circumstance that England, so pre-eminently the home of mechanical invention and skill, should hitherto have failed to produce a good lamp for the combustion of magnesium. A lamp answering this designation must be simple in construction and certain in its operation, the light must be continuous and well under control, and mechanical skill should help to economise a light necessarily costly from the present limited scale of its production. Mechanical ingenuity ought also to assist the continuance of a flame liable to go out so long as it relies for its source upon one solitary wire or ribbon. The best magnesium lamps hitherto invented have come from America, which country has far distanced England in the applications of magnesium, and in the ingenious construction of apparatus for consuming it. In making these remarks we intend no disparagement to Solomon's lamp. It

was constructed with the object of assisting photographers, on dull, wet, and foggy days, to follow their avocation. And as it was early found that from four to eight grains of magnesium were sufficient to take a single portrait, a lamp working from three to five minutes was amply sufficient, and this want Solomon's lamp supplied; but for those manifold uses where the light was required for a longer period, one or other of the American lamps had to be used. But this slur upon English mechanical ingenuity no longer exists. In Larkin's magnesium powder lamp we have a lamp adapted to many requirements. It is very simple in construction, and it need not be a very costly lamp. In it the light is continuous and absolutely under control; the combustion of the metal, and the light arising therefrom, is also greatly economised. The leading features of the lamp are these:—A reservoir, funnel-shaped, and attached to it a long narrow tube, at the end of which is placed a small spirit lamp—these, with mechanical details controlling and guiding each part, constitute the whole of the invention. And yet it will be easily seen that these principles are capable of a great variety of modifications of form and of manifold application. For instance, in the reservoir can be placed, according to the brightness of the flame required, either pure magnesium reduced to dust, or magnesium powder, mixed one-half, two-thirds, or three-fourths with sand, or, if a coloured flame be required, nitrate of strontia or other chemical substances can be added. These mixtures flow down the funnel-shaped tube—as sand flows down the common hourglass—and through a small spirit flame placed at the orifice of the tube, where the magnesium ignites into a continuous flame; the spirit flame insures the ignition of the magnesium, and prevents the fouling and blocking up of the tube by the oxide of magnesium, which would otherwise form around the exit tube. The mixture can be stopped or turned on, as required, by means of a small finger tap. In this way the combustion of the metal is economised, and the amount of light and its continuity are absolutely under control. The hand-lamp now before us, constructed on this principle, is light and portable, hardly exceeding in size an ordinary watchman's lantern. It is not easy to predict the uses opening out for so bright a light and so portable a lamp, but they must be very numerous. It seems admirably adapted for valuing mines and surveying underground workings. It might be used with great advantage in deep sea fishing, and as a decoy light by sportsmen and naturalists; it may also before long be used for lighthouse purposes, and for lighting the entrance to harbours and signalling at sea.

Meetings for the Week.

Tuesday, June 25.

Royal Medical and Chirurgical, 8½ p.m.

Wednesday, June 26.

Society of Arts, 4 p.m. Anniversary.

Friday, June 28.

Quekett Microscopical Club, 8 p.m. Dr. Braithwaite "*On the Organisation of Mosses.*"

On the Decomposing Action of High Temperatures upon some Sulphates,* by M. Boussingault.—It appears from the experiments made that the sulphates of lime, magnesia, lead, &c., are decomposable at a white heat, and that, in consequence, in analytical researches, their calcination should be made only at a moderately elevated temperature; and, although the complete separation of the elements of the acid of the sulphates of strontia and baryta does not take place except at the melting heat of iron, precaution must be taken in their calcining, as it appears certain that the decomposition of these sulphates commences at a much lower temperature. As to the volatilisation of the alkaline sulphates, this must be taken into careful consideration when vegetable ashes are being examined and their proportions estimated; for, if the ashes are obtained at a high temperature, a perceptible loss of alkaline salts takes place, especially those of potassium, which are more volatile than those of sodium.

* Read before the Academy of Sciences, June 10,

NOTES AND QUERIES.

Zinc Paper.—Sir,—Could you afford me information about buying or making zinc paper, covered on one side, as tin paper is?—J. C. J.

Packing for Pumps for Corrosive Liquids.—Sir,—Has Mr. James tried packing the piston with cork fibre? He will find this answer perfectly, and not be acted on by the chlorine.—F. W., Runcorn.

Production of Heat by Percussion.—Sir,—In many elementary works on science it is stated, as an illustration of the above, that blacksmiths are in the habit of hammering a cold nail on the anvil until it becomes red-hot. Have any of your readers ever known of this being done? Can the heat rise to such intensity? Would not the cooling influence of the anvil be sufficient to keep the heat from rising to redness? and would not the iron be flattened out to foil first?—Sceptic.

Preserving Sodium.—Sir,—The simplest and at the same time the most effective means of preserving sodium, is to immerse it completely in oil—Young's paraffin oil is the best—and then to place it in an empty air-tight jar or bottle. It ought to be immersed in oil after every time of using.—M.

Destroying Ants.—Sir,—My house is infected with a very small kind of ant, which at some seasons so swarm about the kitchen cupboards as to be a nuisance. Can you tell me how to get rid of them? They are much smaller and paler in colour than the common garden ant.—E. M.

Use of Superheated Steam.—Sir,—I wish to try a plan of turning superheated steam through an ordinary evaporating pan. Now, I wish to know if any of your readers are aware if this plan has been tried, and with what result? Instead of passing the steam through the pipes of the pan direct from the steam-boiler, I propose to pass the steam through a superheater, and then through the pipes of an evaporating pan, such as may be used for boiling ale, alum liquor, &c. Information on this point will oblige.—S.

ANSWERS TO CORRESPONDENTS.

*** All *Editorial Communications* are to be addressed to the Editor and *Advertisements* and *Business Communications* to the Publisher, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. *Private* letters for the Editor must be so marked.

S. Muspratt.—The letter was addressed and forwarded to the gentleman named.

E. Fairland.—Speaking generally, it is correct to say that the heat from the sun will pass through glass, whilst the rays from a dark source of heat are intercepted. The reason for this is that glass is opaque to heat-rays of the refrangibility of those proceeding from a dark source of heat, whilst it is transparent to those coming from a body so hot as to be brightly luminous.

Physicus.—It is recorded that galena is slightly volatile in the vapour of water, at a high temperature. This might, therefore, account for what you have observed.

J. Bynner.—A gallon of water is required to be converted into steam to drive a railway train a little more than 100 feet. Each puff of steam ejects about half a pint.

F. Carte.—Phosphoric acid solution will take the enamel off a glazed iron dish, but it will not attack good Berlin porcelain.

Still another New Material for Gas Making.—*Apropos* to the suggestion we published recently for turning bodies into gas, a correspondent tells us that, according to a Swiss journal, a means has been discovered of utilising cockchafers. The *Estafette* of Lausanne states that between four and five millions of those insects were recently sent to Friburg for the manufacture of gas, and the residue was found to form an excellent carriage grease.

J. G. T.—We think that the new iron and sulphuric acid pile of M. Monthier differs in some respect from Callan's battery, although it might be considered a "colourable imitation" of it.

Carbo.—Pure caramel may be obtained by placing a solution of crude caramel on a dialyser. The undecomposed sugar and some other matters pass through into the water, whilst the caramel remains behind. It forms when dry a black, highly lustrous mass, soluble in water when it has been evaporated without heat, but insoluble when it has been dried over a water bath.

Communications have been received from John Pollard; August Stromeyer; Dr. Röhrig (with enclosure); Sir B. C. Brodie, Bart.; T. Sterry Hunt; E. Fairland, M.D.; Dr. S. Muspratt; S. Meller; J. Culpar; Oates, Ingham, and Sons; Dr. Letheby; J. Morris, M.D.; F. Field (with enclosure); Avelino Aramayo; A. Sarle; F. Jerningham; C. Heisch; J. West; T. Grubb; J. Spiller (with enclosure); C. R. A. Wright, B.Sc. (with enclosure); J. Robbins; Thomas Reader; Dr. Frankland; Demuth and Co.; J. Turner; J. H. Blunt (with enclosure); T. B. Atkins (with enclosure); Runcorn Soap and Alkali Company; Thomas Hill; W. A. Johnson; J. Thudichum; Thomas Blair; R. Wilding; Joseph Davies; Dr. H. M. Noad; J. H. Swindells; E. P. H. Vaughan; W. Bywater.

Letters are waiting at our office for J. C.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, June 25, 1867.

We have seen petroleum oil recommended in an English paper for the destruction of insects. The method is very efficacious, but Dr. Sacc, of Neufchâtel, in Switzerland, remarks to us that petroleum oil has a more powerful effect upon plants than upon insects; it kills them as if by fire. He saw a magnificent Norfolk Island pine (*Araucaria excelsa*) killed by being doctored with petroleum oil, applied in order to kill the insects. In this case the remedy is worse than the disease.

A young chemist, M. Béraud, relates, in a letter to M. Dumas, how his grandfather, Etienne Béraud, was the first, at the works of La Paille, along with Chaptal, to conceive and put into practice the continuous combustion of sulphur in leaden chambers. "One evening in the year 1795, my grandfather submitted to Chaptal the following project:—A brick furnace is to be constructed close beside the chamber. The fumes of sulphur are to pass into it by means of a leaden pipe three lines thick and a foot diameter, and to prevent the heat from melting the pipe it is to be surrounded by another lead pipe full of water to be renewed when necessary. Chaptal made a thousand objections to this process; the draught produced in the chamber would waste a great quantity of the acid vapours, and take away all the profits of the enterprise. After a long discussion, Chaptal returned home very late; on going to bed he could not sleep, but was haunted with the idea put forward by his pupil and partner. Thinking over his objections, Chaptal found them all disappear one by one, and at last so well did he approve of the proposal that he roused his servant and sent him off to La Paille, a quarter of a league from the town. Of course he found the place shut up and silent, but, by throwing stones at the window-shutters, the man roused my grandfather, who put his head out of the window. The man then cried out—'M. Chaptal has found your idea excellent, and he begs of you to put it into execution the first thing in the morning.'" The new apparatus had such success that three years afterwards the two partners divided 265,000 fr. between them as profits. A portion of this sum was spent in the construction of new works at the Ternes, Paris.

The director of the Dieuze Salt Works, M. Paul Bouquet, and the director of the laboratory, M. W. Hoffman, nephew of the celebrated professor at Berlin, have placed at our disposal a complete memoir on the regeneration of the sulphur from soda waste, which we propose to analyse in sufficient detail to give an exact and clear idea of the whole process. Soda waste, oxidised in the air, is transformed, after a certain time, into two series of compounds; one, insoluble, consists of sulphate of lime, carbonate of lime, silicate of lime, silicate of alumina, silicate of magnesia, and sulphur.

The other is soluble, and consists of polysulphide and hydrosulphate of sulphide of calcium, polysulphide of sodium, hyposulphite of lime, hyposulphite of soda, sulphate of soda, and chloride of sodium. Left to itself, and to the action of rain, the alkaline sulphide varies greatly in strength.

On the other hand, the acid chloride of manganese contains, besides chlorides of iron and barium, free chlorine, hydrochloric acid, water, chlorides of magnesium, aluminium, cobalt, and nickel. If, in order to regenerate the sulphur, we allow the acid chloride of manganese to react upon the soda waste, or on the sulphurous vapours which proceed from it, an abundant escape takes place of sulphuretted hydrogen gas. The presence in the atmosphere of sulphuretted hydrogen caused serious ophthalmia, even when present in a small quantity, which made it necessary for the workmen to stop work for some days occasionally; also, when the quantity of gas was more considerable, the air was infected to such an extent that birds passing over the vessels in which the reaction took place, fell completely suffocated. It was, therefore, necessary to produce a combination which, whilst it separated from the soda waste all the sulphur it contained, would avoid the disengagement of sulphuretted hydrogen, or reduce it to such a degree that its presence would be no longer noxious. It has been ascertained that if the soda waste, on being removed from the lixiviating apparatus, is mixed directly with a certain proportion of sulphates of iron or manganese, these salts are transformed into sulphides. The mixture is then heaped up and left exposed to the air, and is stirred from time to time and kept wetted by a thin stream of water until the metallic sulphides, absorbing the oxygen of the air, are transformed into free sulphur and metallic peroxides. These last, in presence of an excess of sulphide of calcium, are reduced afresh into sulphides of iron and manganese, which, at the end of a short time, are again oxidised in their turn by contact with the air, and so on. The oxygen of the oxides combining with the sulphide of calcium gives rise either to hyposulphite of soda or soluble oxysulphides, the composition of which approaches nearly CaOS. Lastly, the sulphur, being set at liberty by successive oxidations of the metallic sulphides, combines with the sulphide of calcium to form polysulphide of calcium soluble in water.

The process is now carried on at Dieuze, and is based upon the above observation. The experience of several months has practically proved that from the 20,000 litres of chloride of manganese and the 30,000 kilos. of soda waste produced every day at the Dieuze works, 1400 kilos. of pure sulphur can be economically obtained, together with 2200 kilos. of sulphur in the state of sulphides, 770 kilos. of binoxide of manganese at 60 per cent., 20 kilos. of hyposulphite of lime, and 600 kilos. of sulphate of lime, which can be employed instead of kaolin in the manufacture of paper.

A very interesting lecture was given on June 22, in the great hall in the Exhibition grounds at the Champ de Mars, by Captain Craufurd, R.N., F.R.G.S., &c., on the subject of the depolarisation of iron ships, by the method invented by Mr. E. Hopkins, C.E. Captain Craufurd was introduced to the assembly by the writer of this article, under whose auspices the hall was constructed. This instructive lecture was admirably delivered by Captain Craufurd—not in English, but in excellent French; and the practical experiments were conducted by the Rev. E. Hopkins, son of the inventor, and illustrated by a model of H.M. ironclad frigate *Northumberland*. Among the *savants* assembled to hear the lecture of the gallant captain we remarked Admiral Labrousse and M. Gossin, both of geographical fame.

F. Moigno.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Your correspondent, when he promised to go to Paris and communicate his views upon the Exposition, little knew the task he had undertaken!

He arrived at the moment of the advent of the sovereigns of Russia and Prussia, and, for the time, nothing was thought of in Paris but the "Grand Prix," the review, and the preparations for the entertainment at the Hôtel de Ville.

It would be out of place here to detail the grand sights at which your correspondent "assisted," and you would not care to know how near he was to the assassin when a *coup de pistolet* nearly plunged France into a state of anarchy. Let us, then, leave these interesting but unscientific details, and hire a conveyance to take us to the Exposition. But this is more easily said than done. To get a conveyance now in Paris is a feat not to be undertaken too rashly. In one of the so-called comic journals

with which Paris is infested (and at whose jokes we would weep instead of laugh, if the fluids of the body were not dried up by the heat), there is a picture of a family on their knees in the street imploring a coachman to take pity on them and drive them to the Exhibition. The coachman passes on, nose in air; then wildly exclaims the father (as a last resource), "Take the hand of our daughter." From the difficulty we had in Paris to get a conveyance, we believe even that bribe would be insufficient.

The appearance of the Exhibition building from the outside is, as every one has heard, most unprepossessing. At the principal entrance you walk under an awning of dark green, powdered with the Napoleonic bees. On the left is the exquisitely decorated *salon* of the Emperor, on the right the department occupied by the Whitworth and Armstrong guns.

To those who remember the two Exhibitions in this country, especially that of 1851, the general aspect of the French building—whether we regard the interior or exterior—cannot fail to be disappointing.

The arrangement in concentric rings, large as the rings are, effectually prevents the possibility of the existence of great lines, and consequently there is no part of the building or grounds where the view is really grand or imposing. Now, we contend that from the great reputation which the French have not unjustly acquired, and the experience which they have had to help them, we have a right to expect something better.

To say that the French Exhibition as a building, or the arrangements as a whole, can in any way compare with the previous English ones, is simply and obviously untrue. That there is much in the present collection superior to objects of the same class which were in the previous Exhibitions, no unprejudiced person will attempt to deny; but the advance is not so great as might have been anticipated, and of the discovery of new principles, or even really new applications of principles previously recognised, there is scarcely a trace.

To return to our remarks on the general arrangements. We all know the unmerciful manner in which almost all the details of the English Exhibitions were criticised, both at home and on the Continent. But even poor Colonel Sibthorpe never (at least, in our hearing) accused the Commissioners of sacrificing the dignity of a national undertaking with the view of finding amusement for those who were too stupid to feel an interest in the contents of the building. What would have been said if within our grounds we had allowed a music hall after the type of the Alhambra or the Oxford? and yet the present Exhibition contains a *café chantant*, where four or five young ladies sing very French songs, while their audience drink beer and smoke their cigars. What would have been said if within the grounds of either of our Exhibitions we had admitted Richardson's show? and yet in the new Exhibition gardens is a so-called *Théâtre Chinois*, where conjurors swallow swords and toss cups and balls; but we pledge our word that the entertainment of the much-lamented Richardson was decidedly more attractive than that of his French descendant.

The straining after effect evinced in sending Arabs, mounted on camels, to promenade the grounds, is upon a par in taste with the plan adopted of dressing the barmaids in the costume of the country represented by the refreshment rooms in which they display themselves. It is some comfort to our insular vanity, however, to know that the Englishwomen in the ordinary dress of the period immeasurably surpass in appearance their fantastically attired sisters of other nations.

Your correspondent (who has been repeatedly accused of an undue leaning towards French things) has no hesitation in saying that in the Paris Exhibition the dignity of a great national undertaking has been sacrificed to glitter, theatrical effect, and, above all, to the great principle of "making the war pay its expenses."

After the building is closed, the theatre and refreshment bars remain open, and the aspect of the place so much resembles that of a *Mabille* or *Maison Rouge*, that really one would scarcely be astonished at lighting upon groups illustrating the dances of all nations with a *soupçon* of *cancan*.

No unbiassed person of good taste will, we are certain, deny that in grandeur, repose, and dignity, the present French Exhibition, as regards building and arrangements, is inferior to both its English predecessors.

If we were asked what we thought the visitors generally admired most, we should unhesitatingly say the pictures. This, however, is always the case, it being obvious enough that there are more people capable of appreciating pictures than there are of comprehending machines, specimens, and objects illustrating the present state of practical science.

It was, however, decidedly an unexpected—shall we say undesired?—pleasure to meet so many old, very old friends among the pictures. It must, nevertheless, be admitted that infinitely more tact has been exercised by the judges who admitted the pictures (whatever the rejected artists may say) than has been shown by those whose province it was to select the objects considered worthy of representing the present state of chemical manufactures.

We contend that no object should be admitted into an exhibition unless it has to a greater or less extent a characteristic appearance or property. A platinum still *is* a proper object, because, although the platinum might possibly be impure, its appearance in some degree enables the spectator to form a judgment upon it, and moreover its value and beauty render it an object of interest; but cakes, bottles, and tins of blacking, no matter how good in quality, can represent no important advance in excellence, no development of an idea, and serve no purpose whatever save to show the vanity and bad taste of the exhibitor.

When we think how many beautiful works of science and art have been refused space, and how many more have never been sent, owing to the modesty or timidity of their inventors or makers, we cannot refrain from expressing our disgust at seeing cases filled with soda water, baking powders, and blacking.

In our next article we shall return to the description and study of the chemicals in the English department.

Paris, June 15.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, June 20, 1867.

Dr. Warren De la Rue, *F.R.S., President, in the Chair.*

On the minutes being read, Dr. Thudichum protested against the interruption of Mr. R. Davey's speech by the Chairman on the last occasion; upon which Dr. Williamson answered by saying that he merely called to order a gentleman who, instead of speaking on the subject of Sir Benjamin Brodie's paper, was addressing inquiries to Mr. Davey. After this little *contretemps*, and a few words by way of further explanation from Mr. J. Newlands, the minutes were duly confirmed. Mr. J. C. Brough was formally admitted a Fellow of the Society, and the name of Mr. Charles M. Tidy, F.R.C.S., was read for the first time.

Mr. W. H. Perkin read a paper "*On Some New Derivatives of the Hydride of Salicyl.*" The author referred to a previous communication in which he had stated that the hydride of salicyl partook of the properties both of an alcohol and an aldehyde, and, upon extending these experiments, he has succeeded in producing several new derivatives containing the alcohol radicals.

Hydride of Methyl-Salicyl was formed by the action of iodide of methyl upon salicylate of sodium, in sealed tubes heated to 135-140° C. It separates as a light yellow or

nearly colourless oil on adding water to the contents of the tubes. Washed with dilute solution of hydrate of potassium and re-distilled, the product came over at 238°. Its formula was established by two combustions, which gave—

$$C_8H_8O_2 = HC_7H_4(CH_3)O_2.$$

The hydride of methyl-salicyl is isomeric with the hydride of anisyl, but differs from it both in boiling point and odour. It is a true aldehyde, and combines with the bisulphites, the potassium, sodium, and ammonium compounds of which are described.

Hydride of methyl-bromosalicyl was formed as a substitution product by the action of bromine upon the hydride of methyl-salicyl. It separates from a hot alcoholic solution in the form of flat prismatic crystals, which fuse at 113-114·5° C., and have the following composition—

$$C_8H_7BrO_2 = HC_7H_3Br(CH_3)O_2.$$

The actions of ammonia and of nitric acid have been studied; the latter gave rise to the production of two bodies—viz., a dark-coloured oil, which is probably the *hydride of methyl-nitrosalicyl*, and a pale yellow crystalline body, assumed to be *methyl-nitrosalicylic acid.*

Hydride of ethyl-salicyl was formed in a manner similar to the first of this series. It is a nearly colourless, highly refractive oil, boiling at 247-249° C. Its composition is—

$$C_9H_{10}O_2 = HC_7H_4(C_2H_5)O_2.$$

It possesses the properties of an aldehyde, and combines with the alkaline bisulphites.

The hydride of ethyl-bromosalicyl was produced by the action of bromine upon the preceding compound. The crystals fuse at 67-68° C., and contain $C_9H_9BrO_2$.

A new base *hydro-ethyl salicylamide*, $C_{27}H_{30}N_2O_3$, was formed by the action of alcoholic ammonia upon the hydride of ethyl-salicyl, according to the following equation:—

$$3C_9H_{10}O_2 + 2H_3N = C_{27}H_{30}N_2O_3 + 3H_2O;$$

and from this again, by the action of heat, another base which is isomeric with the last, named *ethylsalidine*, the platinum salt of which was prepared and analysed.

By the action of nitric acid upon the hydride of ethyl-salicyl, two bodies appeared to be formed; the first is a yellow oil, heavier than water, assumed to be the *hydride of nitro-ethyl-salicyl*, and the ultimate product gave on analysis numbers corresponding to those demanded by ethyl nitrosalicylic acid. Their production was thus accounted for—

I. $C_7H_5(C_2H_5)O_2 + HNO_3 = C_7H_4(NO_2)(C_2H_5)O_2 + H_2O.$

II. $C_7H_4(NO_2)(C_2H_5)O_2 + O = C_7H_4(NO_2)(C_2H_5)O_3.$

The second stage of this oxidation was said to be analogous to the conversion of aldehyde into acetic acid.

The author further described the compounds resulting from the actions of the iodides of allyl and amyl respectively upon hydride of sodium-salicyl (salicylate of sodium), and concludes with some interesting theoretical considerations arising out of the results of his investigation. It is thus proved that the replacement by alcohol radicals, of the hydrogen usually regarded as alcoholic in the hydride of salicyl, does not in any way interfere with its aldehydic characters. The formation of hydrosalycylamide from the same hydride by the action of ammonia affords, on the other hand, a demonstration of the fact that its properties as an alcohol or hydrate remain unimpaired.

Dr. J. H. Gladstone communicated some further particulars of his research "*On Pyrophosphoric Acid.*" According to Graham's original view of the constitution of this acid, when regarded as $2HO,PO_5$, it was believed to be a bibasic acid. Since the atomic weight of oxygen has been doubled its formula is written $2H_2O,P_2O_5 = P_2H_4O_7$, and it becomes a tetrabasic acid. The correctness of the latter view receives support from the existence of amides containing one, two, and even three molecules of NH_2 in the place of HO. The present paper treats of some normal pyrophosphates and certain allotropic modifications of these salts, and indicates the constitution of the acid as deduced from several modes of formation. The author confirms Schwartzenburg's analysis of the ferric pyrophosphate, $P_2fe_4O_7 + 3H_2O$,* and suggests the existence of a soluble double salt $P_2Na_2fe_2O_7$. The cupric salt was found to have a similar composition, but contained only two atoms of water. Dr. Gladstone mentioned some remarkable facts tending to establish the existence of an allotropic ferric pyrophosphate. Thus, if a solution of sodium pyrophosphate be mixed with a large excess of sulphuric acid and ferric chloride then added, there is no precipitate in the cold, but, on heating, a white flocculent compound is formed, which differs from the ordinary modification of that substance by being insoluble either in dilute mineral acids, ferric chloride, or in alkaline pyrophosphates. A quantity of this substance was prepared and analysed. Its composition was found to be identical with that previously recognised—viz., $P_2fe_4O_7,3H_2O$. It is proposed to use this reaction as a test for the acid in question. Similar results were observed in the case of copper. Regarding the modes of preparation, it was stated that the pyrophosphates had hitherto been obtained by the action of heat upon the orthophosphates, but Dr. Gladstone succeeded in producing them by dissolving phosphoric anhydride in an alcoholic solution of hydrate of potassium or other alkaline base; or if the oxychloride of phosphorus be dropped into a strong aqueous solution of the same hydrate, the product was identical. That this result is true in the case of the strongest ammonia, had been previously shown. The author concluded by tracing the formation of pyrophosphoric acid in stages, as follows:—

I. $PCl_5 + H_2O = PCl_3O + 2HCl.$

II. $2.\left\{\begin{matrix}Cl\\PClO\\Cl\end{matrix}\right\} + H_2O = 2HCl + \left\{\begin{matrix}PCl_2O\\PCl_2O\end{matrix}\right\} O$

III. $\left\{\begin{matrix}PCl_2O\\PCl_2O\end{matrix}\right\} O + 4H_2O = 4HCl + \left\{\begin{matrix}P(HO)_2O\\P(HO)_2O\end{matrix}\right\} O$

Pyrophosphoric acid, $P_2H_4O_7$.

The limited space at our disposal in the present number compels us to defer until next week a full account of the remaining communications.

The titles of the other papers which were read at the meeting were:—"*Water Analysis; Determination of the Nitrogenous Organic Matter,*" by Messrs. J. A. Wanklyn, E. T. Chapman, and Miles H. Smith. "*Analysis of a Biliary Concretion, and on a New Method of Preparing Biliverdine,*" by Dr. T. L. Phipson. "*The Action of Chloride of Iodine on Picric Acid,*" by Dr. John Stenhouse. "*On Julius' Chloride of Carbon, C_6Cl_6,*" by Mr. Henry Bassett.

The President moved a vote of thanks to the authors of these communications, and adjourned the meeting until after the recess.

NOTICES OF BOOKS.

Theology and Natural Science; their Mutual Relations. A Lecture by J. H. Gladstone, F.R.S. Jos. Nisbet and Co.

Dr. Gladstone has endeavoured to show in the present lecture how the study of natural science, being the study of one volume which has issued from the Divine Being, prepares the mind for the reception of the truths delivered in the companion volume of God's word. Both are difficult studies, and in many cases wrong interpretations are arrived at; but the fact that the interpretation of the one record, clashes with the apparent meaning of the other, shows, not that the original works are inconsistent the one with the other, but that our interpretations in neither case are perfect. All the inspired teachers of religion have drawn lessons from the study of nature, whereas Nature has acted the part of a terrible giant, a destructive Jupiter, or an

* Ferricum (fe)= 18·66. (Williamson.)

awful Thor, in the religions that have had no revelation. Science repays the debt by clearing the mind from superstition, by exciting an earnest reverend spirit, by inducing humility of mind, clearness of definition, calmness of judgment.

The slur cast upon science, that it leads to infidelity, is well rebutted by Dr. Gladstone. He states it as his experience that there are no more irreligious men in the walks of science than in other professions. What a man is before he begins to study, that he remains. The religious man becomes more firmly convinced, the irreligious man gains greater scope for scoffing. Science is not necessarily religious, nor is it the reverse; it may be conducive to either end. Dr. Gladstone has spoken kindly, thoughtfully, and well on one of the questions of the day that touches us not as scientific men, but as *men*, who cannot be indifferent when it is sought to place science in opposition to religion.

NOTICES OF PATENTS.

Patent Vital Force.

The great mystery of life, that sages have meditated upon, and philosophers wondered at, in all ages—the Archæus of Paracelsus, the Anima of Aristotle, the Vital spirits of the older physiologists—has at last been cleared up by a brilliant genius who resides in Paris. M. Martin Ziegler has not only demonstrated the existence of a "vital fluid," but has even made the astounding discovery that it is disengaged "whenever azote and carbon are brought into contact." His method is simple—all grand truths are simple—he immerses a porous cell containing ammonia in a vessel filled with treacle! The end of a silk thread is placed in each, and then, on connecting them, "the circuit is closed, and the current of vital fluid passes," capable of producing "on an animated being very considerable effects." No wonder the lucky inventor rushed off and patented his invention at once. He does not, it is true, tell us the precise nature of the "very considerable effects" which he is able to produce, but we can of course have no difficulty in guessing at them, We picture to ourselves the tottering steps and shrivelled limbs of the scarce "animated being," who will seek the patentee's laboratory, his stock of "vital fluid" well-nigh exhausted, and we see him return, after a brief exposure to the life-giving treacle, with the energy and fire of manhood's prime, and with a stock of "vital fluid" enough to last for another fifty years! We can fancy the inventor, with a cask of treacle and a carboy of ammonia, operating at the Morgue before a distinguished assemblage, and bringing back the warm tone of life and health to the cheeks and limbs of the ghastly corpses arranged there. Nay, the experience of Pygmalion himself seems hardly incredible in the light of this new discovery.

We could wish, however, for a little more detail. We should very much like to learn the equivalent in treacle of the vital force of an average man. How many pounds of treacle would be required to bring a man from seventy back to twenty? Would rejuvenescence be a *very* expensive process? And we feel no little anxiety to know whether we are justified in going on living without paying a royalty to M. Martin Ziegler.

We have not been playing upon our readers' credulity. The patent we have been describing has actually been granted to the well-known patent agent Mr. Brooman. Its date is October 3, 1866, and its number 2536. We recommend our readers to examine it, for a more powerful satire on the present state of the patent laws we have never seen. From the following quotations the character of the document can be told:—

"Whenever azote and carbon are brought into contact, whether an azoted body and a carbonated body, or even a body strongly azoted and another which is only feebly azoted, there is disengaged an imponderable fluid, the presence of which is made known by particular effects on the organism of living things, animal or vegetable. This fluid, which the present inventor calls the vital or organic fluid, is thus a new agent generated in the midst of chemical circumstances, like heat, light, and electricity. It is collected, manifested, and transmitted by currents like the electric fluid, as hereafter explained, but notwithstanding that the phenomena by which it manifests itself have a certain analogy with electric phenomena, this vital or organic fluid has really an existence of itself, autonomous and independent, and the best proof of this is, that its currents can pass through conductors which are insulating for electricity. . . . . .

"Azoted bodies are those which are the best conductors of the vital or organic fluids, and among them preference is given to silk, which has the advantage of intercepting the electrical currents, the intervention of which would be inconvenient. As insulating bodies of the vital fluid I may mention glass, enamels, and minerals in general.

"The present inventor has also observed that if an acid or an alkali be made to act upon an organic matter a large quantity of vegetable or organic fluid is disengaged; also that if the organic matter is devoid of azote the disengagement of the fluid takes place if an acid or an alkali be made to react upon a hydrocarburet, or even upon carbon.

"I now proceed to describe several arrangements of apparatus for producing the vital or organic fluid, which are comparable in one point of view with voltaic piles or batteries. . . . . .

"The following is a good arrangement:—A porous vessel or bladder is filled with caustic ammonia and immersed up to the neck in molasses contained in an ordinary vessel; a silk thread is attached to the neck of the porous vessel or bladder, and the end of a second silk thread is placed in the molasses; the two ends of the silk threads being connected, the circuit is closed, and the current of vital fluid passes; its effect will become manifested on an organised being in the line of the current. If a certain number of these elements are gathered together in couples, a dozen for example, by plunging the thread from the ammonia of the first element in the molasses of the following element, and so on, or by connecting on the one side all the threads from the ammonia, and on the other all those from the molasses, a powerful current will be obtained, which produces on an animated being very considerable effects."

CORRESPONDENCE.

Test for Cobalt.

To the Editor of the Chemical News.

Sir,—Having tried some experiments on the new test for cobalt (viz., the production of a deep red coloration on the addition of tartaric acid, excess of ammonia, and ferricyanide of potassium), I found that not only was the coloration produced when tartaric or oxalic acid had been added, but with any other acid (as many as I tried) or salt of ammonia, provided that the acid (or salt), ammonia, and ferricyanide were first mixed and then added to the solution of cobalt.

For instance, the coloration is developed quite as well by the addition of a mixture of chloride of ammonium, ammonia, and ferricyanide, as in the method by tartaric acid. The acids tried were hydrochloric, nitric, sulphuric, carbonic, chromic, and acetic. Probably these experiments have been already tried, but, not having seen them mentioned, I thought it best to place them on record.

I am, &c. Tyro.

Tricks of Trade.

To the Editor of the Chemical News.

Sir,—Drugs and chemicals are not the only things that absorb so much "bribing;" here is a sample of one style, to hand this morning:—

"Messrs. G——— and Co., D**** Street.—The

employés in the above firm most respectfully beg to intimate that they intend celebrating their second annual dinner on Saturday, July 27, 1867. The favour of your subscription in aid of the above will be most thankfully received. Yours respectfully, for the *employés*, A. D**. N.B.—Post Office Orders to be made payable at Gray's Inn Road."

Persistent neglect of all such dishonesty has lost the writer many a customer's trade. But what are we to expect when masters are so ignorant of their own businesses as is generally the case? Having no judgment of their own, nor capability of testing for themselves and proving, they are afraid to unsettle this foreman or that workman. I shall be glad to hear your correspondent's solution of the problem, *how* to neutralise it; but when competition is strong, British honour is a myth.

I am, &c. T. C.

Manufacture of Bisulphide of Carbon.

To the Editor of the Chemical News.

Sir,—Mr. Parkes errs in conveying the impression that my apparatus for the manufacture of bisulphide of carbon was erected under his instructions. The only assistance he rendered me was in directing my attention to the article in Mitscherlich's "Practical and Experimental Chemistry," translated by Dr. Hammock in 1838 (pp. 209-12), which upon examination, you will find, was not calculated to aid me much; and Mr. Parkes' first visit to my works was in 1849, some years after I had been engaged in the manufacture. I am, &c. Jesse Fisher.

Chemical Works, Ironbridge, Salop, June 24.

MISCELLANEOUS.

General Metallurgical Method of Messrs. Whelpley and Storer.—For the application of the chemical portion of this process, the ore must be in the state of very fine powder. The calcination of the ore in this state takes place in what is called a water-furnace. This consists of a fire tower about 20 feet high, 3 feet in diameter at the top, and 4 feet at the base, built of brick with double walls, and having a large water-tank at the bottom. Around the upper portion are four fire boxes, opening into the tower, which is closed and connected with a large fan-blower. By this means, besides the supply of air heated by passing between the two walls of the tower, air and fuel in the state of dust are carried down into the furnace. The heating effects obtained are very surprising. In the calcination of sulphuretted ores, only a moderate temperature and a large supply of oxygen are required. The fire tower of the water furnace being heated to redness, the ore, with or without pulverised fuel, is driven by a small fan down the tower. The sulphur and base metals are rapidly oxidised, and the calcined ore falls into the water-tank below, the current of air being carried through successive chambers open to the tank beneath. In the case of sulphuretted ores of copper, the water-tank is filled with a solution of the chlorides of sodium and calcium, by which, with the aid of a spray wheel at the end where the air current has exit, the sulphurous acid is absorbed, and the oxide of copper converted into the dichloride. Mr. T. Sterry Hunt, F.R.S., finds the reaction to take place according to the following equation :—

$$CaCl + SO_2 + Cu_2O_2 = CaSO_4 + Cu_2Cl.$$

The dichloride of copper is held in solution by the chloride of sodium. A small portion of protochloride of iron generally occurs in the solution, which is separated by addition of oxide of copper, according to this equation—

$$Cu_3O_3 + Fe_2Cl_2 = Cu_2Cl + CuCl + Fe_2O_3.$$

The addition of milk of lime precipitates the whole of the copper as hydrated oxide; simultaneously the bath is regenerated.

The British Association of Gas Managers held a very successful congress at Nottingham on the 11th, 12th, and 13th inst., under the presidency of Mr. Hawskley. About eighty members attended, and thirty-eight new members were elected, the total number now amounting to 178. Several interesting papers were read, including the continuation by Mr. G. T. Livesey of his communication "*On the Practical Working of the Liquor System of Purification;*" a paper by Mr. G. Anderson "*On the Extraction of Ammonia from Gas, and the Utilisation of the Product;*" a communication "*On the Application of Liquid Hydrocarbons as a Substitute for Cannel,*" by Mr. E. Goddard. Mr. E. S. Cathels read a paper "*On Leakage from Gas-mains;*" and papers "*On the Manufacture of Sulphate of Ammonia,*" by Mr. W. Esson; "*On the Explosive Properties of Firedamp,*" by Mr. J. Hutchinson; and "*On the Valves of Purifiers,*" by Mr. W. J. Warner, were also read. Dr. Letheby, as on former occasions, delivered a lecture to the Association, the title of it being "*The Utilisation of the Residual Products of the Manufacture of Coal Gas, with especial Reference to the Production of Aniline Colours from Coal Tar.*" The learned author is preparing a full report of this lecture for our columns. It was agreed to hold the congress in London next year, when a large accession to the number of members is expected to take place, as the metropolitan gas managers, who have hitherto kept aloof, will most probably take that opportunity of joining the Association.

NOTES AND QUERIES.

Gilding and Silvering.—Sir,—Can any of your correspondents inform me how to obtain dead or matt gilding, similar to what is seen on French clocks? Also by whom are watch dials gilt and silvered?—W. Smith.

Ants.—Sir,—I got rid of the ants in my house by adopting the suggestion you yourself made—viz., putting carbolic acid into the holes whence they were seen to issue. A few doses were effectual.—J. Th.

Wood-engraving. — Sir, — A Leipzig wood-engraver, particularly skilled in natural history illustrations, wishes to find a scope for his abilities among British publishers of illustrated scientific works. Perhaps some readers can tell whether there is a want of skilful artists of his kind felt in this country, or whether there is not much chance for a foreigner in this department.—G. L.

Preservation of Sodium.—Sir,—Permit me to observe the following:—Sodium is best of all kept and preserved by coating it with a layer of pure paraffin. I find that the well-known Professor Rud. Wagner, of Würzburg, recommended this mode of preserving sodium some time since, and that it is applied with perfect success. Of course some precautions are necessary, and first and foremost amongst these are, that only *pure* paraffin should be used; that, by being kept in a fused state previously to being applied for this purpose, it should be freed from water entirely; and then that it should be fused at its lowest melting point, 50° Cels., and the sodium (melting point 95°—96° Cels.) immersed in it at no higher temperature than (say) from 55° to 60°. It is easy to remove the coating of paraffin when the sodium is wanted for use.—A.

ANSWERS TO CORRESPONDENTS.

W. S.—The process of depositing silver on glass, which we quoted in full in the review of Browning's "Plea for Reflectors," is the best for your purpose.

R. H. M.—You will find Dr. Roscoe's "Treatise on Chemistry" give you full information.

CH.—The Act compels the condensation of 95 per cent. of muriatic acid gas, but in most works the condensation is more than 99·5 per cent. The average for this year has been 99·27 per cent.

May.—Cyanide of potassium will remove stains caused by nitrate of silver. Remember that it is very poisonous.

Physicus.—If matter be not infinitely divisible, it is, at all events, sufficiently so for all purposes of experiment, or even reasoning. Schiaparelli concludes that the *matter* in a sphere of meteoric cloud 100 miles in diameter weighs about 15 grains; if that be not infinite divisibility, it is a very near approach to it.

Communications have been received from H. James; Jesse Fisher; Dr. Adriani; Dr. Röhrig; Capel H. Berger; Dr. R. Angus Smith, F.R.S.; C. R. C., Tichborne; Professor Williamson, F.R.S.; Dr. Odling, F.R.S.; G. Gore, F.R.S.; H. M. Jenkins; E. P. H Vaughan; Dr. Lunge; C. Greville Williams, F.R.S.; J. Lawrence Smith (Vice-President of Jury, Group 4, Paris, 1867); Dr. Wm. Allen Miller, F.R.S.; the Board of Trade; Burnard, Lack, and Co. (with enclosure); May and Baker; J. S. Parker; J. Swain Window; John Parry; W. Browning; Samuel Collins.

Books Received.—"Chemical Physics," by Dr. Wm. Allen Miller, F.R.S.; "Arithmetic Simplified for General Use," by Neil Arnott, M.D., &c.

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THE CHEMICAL NEWS.

VOLUME XVI.

No. 396.—July 5, 1867.

With this, the first number of the New Series of the Chemical News, we wish to point out to our subscribers several material alterations and improvements.

Our old type is entirely discarded in favour of the quaint, clear, and pleasing character now coming into vogue in publications of a superior kind. Messrs. Stephenson and Blake, the well-known type-founders, who have made a speciality of the old-fashioned character, have cut and cast for us a modern edition of this type, which, whilst avoiding the irregularity of thickness and outline, of type cast from matrices of the last century, retains its picturesque beauty of shape. Messrs. Stephenson and Blake have also supplied us with characteristic *barred* letters, old-style figures, and other symbols peculiar to chemical typography.

It will be observed that a great part of the Chemical News is now printed in a somewhat smaller type; an alteration which does not necessitate any sacrifice of legibility, as the present type is much clearer than that which we have been in the habit of employing. This apparently trifling alteration enables us to give nearly a page more additional matter.

The tinted paper on which the Chemical News is now printed, is not only cool, and comforting to studious eyes, but is more thoroughly in harmony with our old-fashioned type, than the glaring white, eye-damaging paper hitherto used. The quality of paper is likewise considerably improved.

In the space devoted weekly to "communications received," our subscribers will recognise the distinguished position held by various correspondents who honour us with their contributions. When an article appears without a full signature it must not be supposed that it is necessarily the production of the responsible Editor; anonymous contributions by some of the most eminent chemists of the day have often graced our columns, and our new series will be still further enriched by original articles and reviews from distinguished men of science.

The alterations and improvements which we have just organised are of necessity costly, but the price of the Chemical News will remain the same as heretofore. The Chemical News was not established primarily as a commercial speculation. It is true that its circulation, gradually widening, has long ago made it a valuable property; but the Editor and Proprietor is far more anxious to develope its usefulness, than to "put money in his purse;" he has entered into the work solely in the interests of Science, and he is both able and willing to regard the question of profit as a secondary matter, in comparison with chemical efficiency and scientific progress.

ON THE APPLICATION OF THE BLOWPIPE TO THE QUANTITATIVE DETERMINATION, OR ASSAY OF CERTAIN METALS.

By DAVID FORBES, F.R.S., &c.

(Continued from Vol. XV., p. 282.)

Silver Assay. Cupellation Loss.—This term is applied to indicate a minute loss of silver, unavoidably sustained in the process of cupellation, which arises from a small portion of that metal being mechanically carried along with the litharge into the body of the cupel. The amount of this loss increases with the quantity of lead present in the assay (whether contained originally in the assay or added subsequently for the purpose of slagging off the copper, &c.); it is relatively greater, as the silver globule is larger, but represents a larger percentage of the silver actually contained in the assay, in proportion as the silver globule obtained diminishes in size. It has, however, been experimentally proved that in assays of like richness in silver, this loss remains constant when the same temperature has been employed, and similar weights of lead been oxidised in the operation.

In the blowpipe assay this loss is not confined to the ultimate operation of cupellation, but occurs, though in a less degree, in the concentration of the silver-lead, and in

the previous scorification of the assay, had such operation preceded the concentration. The total loss in the blowpipe assay is found, however, to be less than in the ordinary muffle assay, since in the latter case the whole of the oxidised lead is directly absorbed by the cupel.

In mercantile assays of ore it is not customary to pay attention to the cupellation loss, and the results are usually stated in the weight of silver actually obtained. Where, however, great accuracy is required, especially when the substances are very rich in silver, the cupellation loss is added to the weight of the silver globule obtained, in order to arrive at the true percentage.

The amount to be added for this purpose is shown in the annexed table, which is slightly modified from Plattner's :—

Actual per-centage of silver found by assay.	Cupellation loss, or per-centage of Silver to be added to the actual per-centage found by assay in order to show the true per-centage of silver contained in same. The entire amount of lead in or added to the assay being the following multiples of the original weight of assay :—									
	1	2	3	4	5	6	8	11	13	16
99·75 } 99·5 }	0·25	0·32	0·39	0·45	0·50	—	—	—	—	—
90.....	0·22	0·29	0·36	0·42	0·47	0·69	0·83	—	—	—
80.....	0·20	0·26	0·33	0·39	0·44	0·64	0·75	—	—	—
70.....	0·18	0·23	0·29	0·35	0·40	0·58	0·68	0·82	—	—
60.....	0·16	0·20	0·26	0·30	0·36	0·52	0·61	0·74	—	—
50.....	0·14	0·17	0·23	0·26	0·32	0·46	0·54	0·65	—	—
40.....	0·12	0·15	0·20	0·22	0·27	0·39	0·46	0·55	0·62	—
35.....	0·11	0·13	0·18	0·18	0·25	0·30	0·42	0·50	0·57	—
30.....	0·10	0·12	0·16	0·16	0·22	0·32	0·38	0·45	0·51	—
25.....	0·09	0·10	0·14	0·14	0·20	0·29	0·34	0·40	0.45	—
20.....	0·08	0·09	0·12	0·12	0·17	0·25	0·29	0·35	0·39	0·45
15.....	0·07	0·08	0·10	0·11	0·15	0·20	0·23	0·28	0·32	0·37
12.....	0·06	0·07	0·09	0·10	0·13	0·17	0·19	0·23	0·26	0·32
10.....	0·05	0·06	0·08	0·09	0·11	0·15	0·17	0·20	0·23	0·27
9.....	0·04	0·05	0·07	0·08	0·10	0·14	0·16	0·18	0·21	0·25
8.....	0·03	0·04	0·06	0·07	0·09	0·13	0·15	0·16	0·18	0·22
7.....	0·02	0·03	0·05	0·06	0·08	0·12	0·13	0·14	0·16	0·20
6.....	0·01	0·02	0·04	0·05	0·07	0·10	0·11	0·12	0·14	0·17
5.....		0·01	0·03	0·04	0·06	0·09	0·10	0·11	0·12	0·14
4.....			0·02	0·03	0·05	0·07	0·08	0·09	0·10	0·11
3.....			0·01	0·02	0·04	0·05	0·06	0·07	0·08	0·09
2.....				0·01	0·03	0·04	0·04	0·05	0·06	0·07
1.....					0·01	0·03	0·03	0·04	0·04	0·05

The use of the above table is best explained by an example, as the following :—An assay to which there had been added, in all, five times its weight of assay lead, gave a globule of silver equivalent to six per cent. Upon referring to the table, it will be seen that the cupellation loss for this would be 0·07; consequently the true per centage of silver contained in the assay would be 6·07. This table is only extended to whole numbers, but fractional parts can easily be calculated from the same.

When the globules of silver are so minute that they cannot be weighed, but must be measured upon the scale, the cupellation loss should not be added, since, as a rule, it would be less than the difference which might arise from errors of observation likely to occur when measuring their diameters upon the scale.

In the case of beginners, it will be found that the cupellation is usually carried on at too high a temperature, and that thereby a greater loss is occasioned than would be accounted for by the above table. After some trials the necessary experience will be acquired in keeping up the proper temperature at which this operation should be effected.

Silver Assay.

It now becomes necessary to consider in detail the processes requisite for extracting the silver contents (in combination with lead) from the various silver ores, and other argentiferous compounds, which are met with in nature or produced in the arts.

In considering these, the following classification of the substances will be found convenient :—

I. Metallic Alloys.
  A. Capable of direct cupellation.
  a. Consisting chiefly of lead or bismuth : silver lead and argentiferous bismuth, native bismuthic silver.
  b. Consisting chiefly of silver : native silver, bar silver, test silver, precipitated silver, retorted silver amalgam, standard silver, alloys of silver with gold and copper.
  c. Consisting chiefly of copper : native copper, copper ingot, sheet or wire, cement copper, copper coins, copper-nickel alloys.
  B. Incapable of direct cupellation.
  a. Containing much copper or nickel, with more or less sulphur, arsenic, zinc, &c.; unrefined or black copper, brass, german silver.
  b. Containing tin : argentiferous tin, bronze, bell metal, gun metal, bronze coinage.
  c. Containing antimony, tellurium, or zinc.
  d. Containing mercury : amalgams.
  e. Containing much iron : argentiferous steel, bears from smelting furnaces.

II. Mineralised Compounds.
  a. Silver and other ores, furnace products, sweeps, and products of the arts containing sulphides, arsenides, and other compounds of the metals in combination with more or less earthy matter.
  b. Argentiferous sulphide of molybdenum.
  c. Substances nearly free from sulphides or arsenides, but containing chlorine, iodine, or bromine.
  d. Argentiferous litharge, and other easily reducible oxides.

I. A. Metallic Alloys capable of direct Cupellation.

a. Consisting chiefly of Lead or Bismuth.—In determining the silver contained in these alloys, it is only requisite to place a clean piece of the same, weighing about from one to ten grains according to its probable richness in silver, upon a cupel of coarse bone ash, and proceed by concentration and cupellation exactly as has been already described under these heads.

Should the substance be not altogether metallic, or not free from adherent slag, earthy matter, or other extraneous matter, it should previously be fused on charcoal with a little borax in the reducing blowpipe flame, and the clean metallic globule then removed from the charcoal, and treated as before. In order to remove the globule from the inherent borax glass, it may be allowed to cool, and then detached ; or, after a little practice, it will be found easy, by a quick movement of the charcoal, to cause the globule still melted to detach itself completely, and drop on the anvil in the form of a single somewhat flattened globule, without suffering any loss of lead adhering to the charcoal.

In the case of argentiferous bismuth alloys the process is carried on in all respects the same as if silver-lead were being treated. As, however, the bismuth globule is very brittle, care must be taken when separating the concentrated globule from the litharge, as, if not carefully done, a loss may easily be sustained from a portion of the globule remaining behind adherent to the litharge. It is better, therefore, to remove the litharge by degrees from the globule with the aid of the forceps.

Argentiferous bismuth, free from lead, when cupelled alone, invariably leaves a globule of silver, having a dull frosted surface. If, however, at the end of the operation a small quantity of lead (¼ to ½ a grain) be added, and fused along with it, the silver globule then obtained will be perfectly bright and free from all bismuth.

In the case of native bismuthic silver it is advisable to fuse the previously weighed mineral with a little lead and borax glass on charcoal in the reducing flame, so as to free it from any adherent earthy matter, and then proceed by concentration and cupellation, as before described.

NOTE ON THE CALCULUS OF CHEMICAL OPERATIONS.

By Professor WILLIAMSON, F.R.S.

The remarkable memoir of Sir Benjamin Brodie, respecting which these remarks are made, is the first consistent attempt to introduce analytical reasoning into the body of the science of chemistry.

One fundamentally important question of method is raised by the memoir; and as it may be considered apart from the rest of the subject, and is, in fact, a preliminary to any discussion upon it, the author wishes to draw attention to some considerations relating to it.

Sir B. Brodie defines a chemical operation as an operation performed upon the unit of space, of which the result is a weight. The unit of matter (or molecule) adopted is the weight of matter of a specified kind, which occupies in the state of perfect gas the volume of one litre at 0°C. and a pressure of 760 millimetres of mercury.

This absolute definition is intended to supersede the prevailing theory that the molecule of each compound is the smallest proportional weight in which we can, consistently with its other properties, represent it as taking part in any reaction, or in which we can suppose it to exist by itself.

In some cases the vapour-densities of many compounds have confirmed the molecular weights assigned to them by a comparison of their reactions; but in other cases, many of which are too familiar to need mention here, the vapour-density contradicts the above evidence of the molecular weight. What is the result in such a case of conflict? Uniformly this: that if the vapour-density and reactions are irreconcileable, we know that the vapour-density must have given wrong advice, and it only remains to be seen by an examination of the anomalous vapour how the molecule broke up on evaporation.

Perhaps the best way to judge of the working of the new definition is to see the manner in which Sir B. Brodie himself applies his principle. Thus, at page 817 of his memoir, the units of thirteen substances are given, and opposite each formula is given the "absolute weight in grammes" of a litre of the vapour, and in another column the "relative weights" of each. Of these fundamental statements four only—viz.: the numbers for sulphur, sulphuretted hydrogen, sulphurous acid, SO_2, and sulphuric acid, SO_3, are the records of observations. The numbers for three other substances are at variance with observation, for SO_3H_2 breaks up on evaporation into SO_2 and H_2O, forming a mixed vapour of about half the density given. SO_4H_2 breaks up similarly, forming a vapour of about half the specific gravity assumed, and Nordhausen acid first breaks up into SO_3 and SO_4H_2, and this hydrate decomposes at a higher temperature, as above mentioned. The vapour from Nordhausen acid has, therefore, a specific gravity vastly below that assumed. No doubt there are good reasons derived from a study of other facts for believing that these three compounds, *if they were capable of evaporating undecomposed*, would have the vapour densities assigned to them by Sir B. Brodie; but taking the simple definition as given, we are led to molecular weights, which the author, in common with all chemists, considers inadmissible, and which he very properly corrects.

The other six substances of the table are more unstable compounds, which have never been evaporated without even more permanent and fundamental changes in their composition. It would be easy to multiply instances, but enough has been said to illustrate the fact that molecular formulæ are not deduced from mere vapour densities, and that we should only be justified in taking a fixed vapour volume, as the definition of molecules, if we could show that from the vapour densities of compounds their molecular weights could be inferred with certainty.

There are strong reasons against the supposition that the molecules of chemistry can all, or nearly all, exist in the state of vapour. If we were to speculate upon the probable distribution of the elements at a temperature sufficiently high for the volatilisation of all known substances, it would be safe to assume that a very great, if not the greatest, number of known molecules would be resolved into others containing a smaller number of atoms.

Numberless known molecules are notoriously broken up at temperatures within easy reach of every operator, and there is reason to anticipate that the progress of research will gradually give us more insight into the conditions of condensation which distinguish volatile from non-volatile molecules, so as to explain why the latter cannot exist in the gaseous state.

It is, moreover, not only undesirable on the ground of accuracy, but also exceedingly inconvenient, to define chemical molecules as being one litre of vapour, for the artifice necessitates the establishment of a new scale of atomic weights and molecular weights.

The molecule of hydrogen in this scale weighs	0·089
,, ,, ,, oxygen	1·430
,, ,, ,, nitrogen	1·251
,, ,, ,, chlorine	3·173
,, ,, ,, steam	0·805
,, ,, ,, ammonia	0·760
,, ,, ,, hydrochloric acid	1·631

The numbers represent in grammes the weight of a litre of the respective substances.

If we retain the ordinary molecular weight—viz.:

Hydrogen	2	=	H_2
Oxygen	32	=	O_2
Nitrogen	28	=	N_2
Steam	18	=	H_2O
Ammonia	17	=	NH_3
Hydrochloric acid	73	=	ClH

we have numbers which are easily remembered and easily used, and which answer all the purposes of the other numbers, in a far more convenient manner. Relations between these short numbers are seen at a glance, and computations are rapidly made with them in the head, which, with the numbers of the *crith* series of the litre, are comparatively slow and difficult. Calculations relating to any absolute measure are most easily made upon the basis of the common molecular weight. One constant has to be used for the reduction in absolute volume—viz.: 11·2 litres, or the volume, at the normal temperature and pressure, of one gramme of hydrogen. Every formula of a volatile molecule represents 22·4 litres of the vapour, weighing as many grammes as there are units in the molecular weight.

Some interesting considerations are suggested by the proposal to consider the molecule of hydrogen as containing only one atom, and the molecules of chlorine, bromine, iodine, nitrogen, phosphorus, arsenic, &c., as each compounded of one atom of hydrogen with two atoms of elements at present unknown. The formula for hydrochloric acid is $a\chi$, which we may define, $a\chi = HCl$, and this combined with the fundamental assumption $a = H_2$, gives us $H_2\chi = HCl$, whence $\chi = \frac{Cl}{H}$. In like manner the symbol of chlorine, $a\chi_2$, may be translated into ordinary symbols by the aid of the equation $a\chi_2 = Cl_2$, in which we replace a and χ by their values as above.

$$Cl_2 = H_2 \cdot \frac{Cl_2}{H_2}$$

In explanation of the symbol $\frac{Cl}{H}$ it is merely stated that it represents an atom of chlorine from which an atom of hydrogen is removed. Chemists employ the sign of multiplication to denote combination, as in HCl, and the sign of division is here employed to indicate decomposition.

The assumption that two molecules of hydrochloric acid decompose so as to form a single atom of hydrogen,

necessarily involves for a molecule of the acid a formula like $a\chi$, representing it as one atom of hydrogen, to which another atom $\overset{Cl}{H} = 34{\cdot}5$ is united.

$H_2\overset{Cl}{H}$ is the translation of the formula of hydrochloric acid; and when two such molecules are decomposed into hydrogen and chlorine, the process consists in removing H_2 from one of them, and combining the residue $\overset{Cl}{H}$ with the other molecule of acid, forming $H_2\overset{Cl_2}{H_2}$

In like manner hydrobromic acid is described by the symbol $H_2 \cdot \overset{Br}{H}$.

$$\text{Bromine} \ldots\ldots = H_2 \cdot \overset{Br_2}{H_2}$$

$$\text{Hydriodic acid} = H_2 \cdot \overset{I}{H}$$

$$\text{Iodine} \ldots\ldots = H_2 \cdot \overset{I_2}{H_2}$$

$$\text{Ammonia} \ldots\ldots = H_4 \cdot \overset{N}{H}$$

$$\text{Nitrogen} \ldots\ldots = H_2 \cdot \overset{N_2}{H_2}$$

The author is inclined to think that the hypothesis adopted respecting the constitution of chlorine, nitrogen, &c., might, with advantage, be extended to oxygen and other atoms of even equivalence, if adopted at all, so as to represent those elements as containing hydrogen. Oxygen can be supposed to be built up from water by the addition of an increment of weight, analogous to the increment which transforms hydrochloric acid into chlorine. Water would thus be represented by a symbol of the usual form (say $a_2\phi$), and the decomposition of the unit of water into two units of hydrogen, and one unit of oxygen would be represented in a manner analogous to that adopted in the case of hydrochloric acid. One unit of water would lose ϕ, liberating two units of hydrogen, which ϕ would enter into combination with the other unit of water, thereby forming $a_2\phi_2$. $a_2\phi_2$ is thus the symbol of oxygen, and ϕ is an element which is contained in oxygen, and which leaves it to unite with two atoms of hydrogen.

Let a represent 2 grammes of hydrogen = 22·4 litres.
$a_2\phi_2$,, 32 grammes of oxygen.. = 22·4 ,,
$a_2\phi$,, 18 grammes of steam .. = 22·4 ,,

Then ϕ is the symbol of an imaginary element, representing the increment to be added to 4 grammes of hydrogen, when they are converted into 18 grammes of water. The weight of ϕ is, therefore, 14. It may be translated thus:

$\phi = \overset{O}{H_2}$, and if $a = H_2$, we have $2H_2 + H_4\overset{O_2}{H_4} = 2H_4\overset{O}{H^2}$.

The following equation represents the process:

$$2a + a_2\phi_2 = 2a_2\phi.$$

It is interesting and important to observe that Sir B. Brodie's fundamental hypothesis is an atomic hypothesis, viz., that the molecule of hydrogen consists of one atom instead of containing two atoms, as we have been accustomed to see it; and that in constructing each molecular formula he limits himself to some integral number of atomic weights.

In weighing the arguments which will, no doubt, be brought forward in favour of the proposed change, chemists will need to compare the whole of the new system to the old one. Such comparison can only be made when the new systems are before us. The author hopes, before long, to bring forward various considerations relating to the interpretation and application of our present system of chemical facts and theories. He wishes now to point out that the proposed system would be at an unnecessary disadvantage in the comparison or contest, if it were left to rest on the quicksands of conjecture respecting vapour densities.

CHEMICAL COMPOSITION OF STREET MUD.

By C. R. C. Tichborne, F.C.S.

The communication on the above subject, from Dr. Letheby, which appeared in the last number of the Chemical News, possesses to my mind considerable interest, from two causes. First—from its important sanitary aspect, and second—from the fact that last year, I endeavoured to bring prominently before the authorities of the city of Dublin, the highly deleterious nature of street dust, or mud, which from their hygienic point of view was vulgarly looked upon as harmless. In a letter published in the *Irish Times*, Tuesday, October 9, 1866, I gave the analysis of the mud taken from one of our narrowest streets, but which street was, and is to the present day, our greatest thoroughfare. The letter was written at the commencement of the severe attack of cholera with which Dublin was visited last autumn, and was published mainly with a view to advocate the use of carbolic acid for watering the roads. On referring to my notes, I find that the street dust in Dublin contained on an average 24 per cent of organic matter, which is lower than the average given by Dr. Letheby for the London mud, even allowing for difference of moisture. This lower per centage is probably owing to the much larger per centage of animals working upon the same extent of roads, or also because many of our streets are macadamized, or constructed in a similar manner. From the continual state of steeping, (if I may use the expression) and re-drying that this comminuted manure is constantly undergoing, I am of opinion that we are hardly alive to the mischief that it is capable of perpetuating. Antiseptics, such as carbolic acid, from their expense, are inadmissible for general use in the ordinary course of events. In seaport towns an efficient antiseptic, and harmless friend, would be found in the sea-water. This should be used freely for watering the streets. In dry and hot weather the saline substance very soon accumulates, and the sea-water leaves a perceptible hard crust of the briny matter. From its slightly deliquescent nature it answers its mechanical requirements admirably, and during the usual dry weather adds no expense to the work ordinarily done to restrain the dust. The three and a half per cent. of chloride of sodium &c. contained in sea-water collects rapidly when exposed to superficial evaporation, even in damp weather, and it would be next to impossible that fermentable changes could take place in the presence of so large a proportion of sea-salts.

Such a project would perhaps be hardly feasible in a city like London, which is situated so far from the mouth of the river, but it could be easily adopted in such towns as Liverpool, Portsmouth, Dublin, &c. The following analyses taken from my note book of last year, may possess some interest in connection with my remarks.

Moist Dust from Grafton-street, Dublin, October, 1866.

Moisture	33.3
Organic matter	25.1
Inorganic matter	41.6
	100.0

Street Dust, October, 1866.

Soluble salts	1.3 per cent.
Organic matter	25.1

Soil from a well made road upon which sea-water had been used.

Soluble salts	7.5 per cent.
Organic matter	21.1

Here it will be seen that the salts are about ⅓ the weight of the total organic matters present.

Behaviour of Lime when Burned.—Dorlhar and Saminn. Two cylinders formed out of the same piece of limestone measured 27 millimètres in length and 17 millimètres in diameter. After being completely burned their volume had increased nearly 1-10th—viz., to 28 millim. and 17.7 millim.—*Berg. und huttimm, Zeitung*, 1867.

FOREIGN SCIENCE.

(From our own Correspondent.)

Baron Liebig's Artificial Milk; Death of the Patients—Liquid Diffusion applied to the Extraction of Cane Sugar—Effect of Tobacco and Snuff in Impairing Memory.

Paris, July 3rd, 1867.

Artificial Milk.—At the last meeting of the Academy of Medicine, M. Giboust, Professor at the School of Pharmacy, read a paper which we cannot help noticing. He called the attention of the medical world to the description given of the artificial milk invented by Baron Von Liebig, and regretted very much being obliged to enter into a controversy with him. After having reminded the assembly of the composition of this milk, and insisting upon the difficulties attending the preparation of such aliments in places where it might be most necessary, such as with wetnurses or small families, M. Giboust added that we have at our disposal a natural product which more nearly resembles human milk than does a mixture of cow's milk, flour, malt, lactate and butyrate of potash. It is cow's milk itself. On an average, human milk contains a little more water, more sugar of milk, less butter and caseine than cow's milk. Thus, by taking the latter, and adding a little sugar and a fifth of its weight of water, we have an aliment, at the disposal of everybody, forming a better substitute for human milk than any artificial compound.

M. Depaul, on his part, declared that he undertook experiments on new-born children, to examine the effects of this artificial milk, the taste of which was, by the bye, less agreeable than that of natural milk. Four children were tried. The two first were twins, and born prematurely. In spite of the care bestowed on them, and the nourishment by the artificial milk, they died in two days. The third, born at full time, weighed 3 kilogs. 370 grammes; the mother was ill. The nourishment given was that of artificial milk. At the end of two days, the dejections became green, and on this day the child perished. The fourth infant, born under the same conditions, and nourished with the same aliment, died after four days. M. Wurtz promised to write to Baron Von Liebig, to obtain more precise details on the preparation of this milk.

Diffusion, by M. Robert of Seelswitz, applied in the East Indies for the extraction of cane-sugar.—Previous to a voyage to the East Indies, he traversed Germany and Austria, with the intention of studying the progress made in the manufacture of beet-root sugar in those countries, and to see how far the method could be introduced into the East Indies, for the manufacture of cane-sugar. This process of extracting the juice of the beet-root by means of diffusion was invented by M. Jules Robert, of the firm of Robert and Co., proprietors of works situated in Moravia. Struck with the simplicity of this process, which with cheap machinery and scarcely any wear and tear, gives a finer and more abundant juice at less cost than the usual process, he consulted M. Jules Robert on the possibility of applying this method to the sugar in the East Indies, and the only difficulty was, that of having a machine to cut the cane into the required lengths, inasmuch as cane from its hardness, presented greater resistance. A cane cutting machine was constructed at Seelswitz, which was found to work successfully on maize stalks. Four engines were sent to the East Indies, along with a triple evaporator. Up to the time of sending off the samples to the Champ de Mars, 1,500 tons of sugar-cane had been prepared. A steam engine of 12-horse power, four cane cutters, and diffusing apparatus in wood will suffice for 70 tons of sugar-cane. The advantages have been found to be:—1. Less force is necessary, for equal weights of cane, to cut the cane into slices than to drive rolling machines. 2. That diffusion extracts a juice purer than that obtained by mills. 3. That diffusion extracts from the same quantity of cane 20 per cent more juice than by mills, as is proved by the comparison of the weight of the stalks and the residues of the diffusion. 4. As the cane contains less pectose than the beet-root, the temperature can be allowed, without inconvenience, to exceed 50°C, and even to amount to 70°C. This is important, because diffusion is quicker at a higher temperature.

Tobacco.—The Abbé Migne has just addressed a letter to a very honourable director of one of the great seminaries of Paris, condemning the use of tobacco and snuff. This letter furnishes us with an opportunity of relating a fact that is personal to us. Several times in our youth and riper age we have taken up and discarded the use of the snuffbox. In 1861, when writing our mathematical treatises, during our labours with M. Lindelof, for the calculation of variations, and when we commenced the editing of our lectures on analytic mechanics, we used snuff to excess, taking 20 to 25 grammes per day, incessantly having recourse to the fatal box and snuffing up the dangerous stimulant. The effect of this was, on the one hand, the stiffening of the nervous system, which we could not account for; on the other hand, a rapid loss of memory, not only of the present but of the past. We had learned several languages by their roots, and our memory was often at a loss for a word. Frightened at this considerable loss, we resolved in September, 1861, to renounce the use of snuff and cigars for ever. This resolution was the commencement of a veritable restoration to health and spirits, and our memory recovered all its sensibility and force. The same thing happened to M. Dubrunfaut, the celebrated chemist, in renouncing the use of tobacco. We do not hesitate in saying that for one moderate snuff-taker or smoker there are 99 who use tobacco to excess.

F. Moigno.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Copyright of the Medals—An Explanation Wanted—Awards of Gold and Silver Medals—Extract of Meat.

In our last communication we felt ourselves bound to express our opinion somewhat strongly regarding some of the more salient and least agreeable of the features of the Paris Exhibition. Grumbling comes so naturally to us English, and is therefore so completely to be expected from a "Special Correspondent," that, feeling a little ashamed to think we had fallen so easily into the conventional groove, we determined to complain no more, but proceed like Hotspur in the *Telegraph* to point out the probable winners. At this moment the following circular was placed before us:—

"*Notice to Exhibitors.—The Medals.*

"The Jurors' Awards, and Medals, and Honourable Mentions will be published in course of a few days, and duly notified to the successful Exhibitors.

"The copyright of the Medal being vested in us by the Imperial Commission, and fully secured for the United Kingdom (13 and 14 Vic., cap. 104, and at Stationers' Hall), we have the exclusive right to publish fac-simile copies of the Medal, as well as to supply all reproductions of the design by every process of printing, photography, embossing, electrotyping, or otherwise.

"Exhibitors desirous of introducing the medal on their show cards, labels, or other printing should favor us with instructions immediately on receipt of notice of award.

"J. M. Johnson and Sons,
Sole Concessionaires."

This precious document, (precious alike in style and spirit) in one sense is to be received with enthusiasm. Henceforth who shall dare to call us "a nation of shopkeepers"? The writer contends that to sell any firm such a monopoly is eminently disgraceful. Every exhibitor then who obtains a Medal or Honourable Mention is to be forced to wait as long for his bill heads, blank invoices, or headed papers, as "MM. the Concessionaires" please, and will

also be compelled to pay any price for them they may choose to demand. "M.M. the Concessionaires" may, for ought we know or care, be absolutely incapable of presuming unduly on their exceptional position; but, if they do not it will solely be due to their good feeling and moderation. It is more than ever evident that everything connected with the Exhibition is "sold," especially the "Exhibitors." It is generally believed, however, that "M.M. the Concessionaires" will not have the resources of their establishment too heavily taxed. "In things gone by we see the archetypes of things that are to come." *Verbum sap.*

One word more; the readers of this Journal will have observed that in its advertisement columns it is not unusual to have illustrations of Exhibition Medals. Is it then to be understood that if any English Firm, after having won a medal, should wish to have a cut of it as a heading to their advertisement, such firm will have to pay a tax to "MM. the Concessionaires"? And are we to understand that in default they will have infringed the rights "... fully secured for the United Kingdom (13 and 14 Vic., cap. 104, *and at Stationers' Hall*)"? We call upon the authors of this wonderful parenthesis to define distinctly the position of advertisers in this matter. If this tax is intended to be enforced it is to be hoped that the English Medalists will refuse to lend themselves to what can only be characterised as a most odious monopoly.

It is with pain that your correspondent has felt called upon, by an absolute sense of duty, to make some of the remarks to be found in this and the last letter. It is desired, therefore, before proceeding with the criticisms upon the contents of the Exhibition, to state that despite, what has been said, the writer is deeply and most favourably impressed with the vast majority of his French experience. Red tape is always red tape; the red tapists, like Talleyrand's fair enemy, have but one defect, they are insupportable. The French *people* in general we cannot speak too highly of. It has been said that the grand old French politeness is disappearing: we deny it. Go where we would, we found not only civility and politeness, but kindness and good feeling. Depend upon it, where English people do not meet good treatment in France, it is because by their insular pride and gaucherie they render good treatment impossible. How often do we hear our countrymen use the idiotic expression "I do not like foreigners." Your true cosmopolitan does not care whether the man he meets is a foreigner or not, if he behaves well he should receive corresponding treatment. Apologising, as in duty bound, for this digression, we resume our study of the objects exhibited. As we stated in our last letter but one, we shall endeavour to take the cases as they are numbered in the Exhibition Catalogue.

In addition to cod-liver oil, Messrs. Allen and Hanbury, of Plough-court, exhibit Liebig's extract of meat, manufactured in Australia at the establishment of Mr. Robert Tooth, of Sydney, who was the first person in Australia to establish works for the manufacture of this article. Up to the present time at Mr. Tooth's works they only employ beef as the raw material. These works alone produce no less at the present time, than between 8,000 and 10,000 lbs. per month, and the resources of the manufactory are such that they are capable of yielding a much larger quantity than this.

When we reflect that 10,000 lbs. of extract represent no less than 160,000 lbs. of the lean flesh, we are in a position at once to see the amount of work that must be gone through in a short time, in order that so perishable a raw material may not be allowed to spoil.

This extract of meat is so rapidly finding its way into our kitchens, and is becoming so much used as "stock" for soups and as the basis of gravies, that it bids fair to become one of the most valuable of our imports, and it is interesting to see that the idea of concentrating a large amount of nutritious matter in a small compass is being worked out in other directions. Powdered meat is now being imported, and if of really high class quality will probably be used in many cases where the employment of the extract would be inadmissible.

We would earnestly, however, caution the manufacturers of these essences or extracts, and powders, against allowing ever so small a quantity of bad quality to find its way into the market. Such substances are precisely those which people at first are slow to appreciate and adopt, and one or two bad samples, by disgusting the purchasers, will retard the sale within a considerable area.

We are now able to announce that no less than 88 gold, 325 silver, and 400 bronze medals have been gained by Bristol firms, and that 270 of those sources of all despair to exhibitors, viz., honourable mentions, have also been inflicted.

Among the exhibitors of chemical and pharmaceutical products the following have obtained gold medals:—

C. Allhusen, and Sons, Tyne Chemical Works, Gateshead, and Newcastle-upon-Tyne, bicarbonate, sulphate, and crystals of soda, alkali, caustic soda, chloride of lime, &c.

W. Gossage and Sons, Widnes, near Warrington, for soaps, and silicates used in making soaps.

The Jarrow Chemical Company, South Shields, for specimens of chemical products.

James Muspratt and Sons 41, Oldhall-street, Liverpool, for chemical products connected with the manufacture of alkali.

Howard and Sons, Stratford, salts of quinine and other chemicals.

Price's Patent Candle Company (Limited), Belmont Works, Battersea, for candles, night-lights, oils, soaps, and glycerin.

James Young, Chemical Works, Bathgate, Scotland, for solid paraffin, candles, oils, &c.

Johnson, Matthey, and Co., Hatton-garden, for articles in platinum and other precious metals. In this instance there has been an award of what, in University language, may be called a "double first," as they have also received a gold medal in group 6, as well as a silver medal.

It is a most invidious task to criticise awards of medals in these cases. We all know how enraged every exhibitor becomes who does not get a medal. We must remember, however, that, in the first place, many of our best houses, disgusted with the labour, expense, and loss of time entailed by exhibiting, had refused to send anything to Paris. In the next place, there is no doubt that a very large proportion of the chemicals and drugs exhibited were not above mediocrity.

We regret that so much of the small space which is weekly at our disposal has of necessity been spent in discussions not immediately connected with the chemistry of the Exhibition. Now, however, that the awards are given, we hope that nothing further will arise to force us to occupy our letters with matters unconnected with science.

The following firms have obtained Silver Medals:—Bailey, Bewicke, British Seaweed, Calvert, H. B. Condy, Cow, Hill, Denton and Jutsum, Demuth, Field, Gaskell, D. and W. Gibbs, Hopkin and Williams, Hurlet Alum Company, Johnson and Matthey, Knight, Macfarlane, Mander Brothers, Mawson, Ogleby, Parkes, Rose, Smith, Tudor, Walker Alkali Company, Warne, Wilkinson. Bronze Medals:—Adams, May, and Baker (Class 30), Britannia Rubber, Burgoyne, Bush, Calley, Clark, W. Cook and Co., Danley, Davy Yates and Routledge, Day and Martin, Dodge, Garrod, Goodwin, Green, Haas and Co., Hodgson and Simpson, Holland, Hosegood, Huskisson, J. Jarrow, Langton and Bicknells, Lamb and Sterry, Lange and Moselle, Lowe (Manchester), M'Dougall, M'Kay, Mason, Nimmo, J. N. Parker and Co., Pulford, W. Ransome, Rogers, Rumsey, Squire, Stephens, Talbot and Alder, W. Taylor and Co., Turner and Son, Wandle, Waring.

Class 45.—Specimens of the Chemical Processes used in Bleaching, Dyeing, Printing, and Dressing.—Silver Medal:—Hands, Ripley. Bronze Medal:—Barlow, Dickens, Howe. Honourable Mention:—Whincup.

REPORTS OF SOCIETIES.

CHEMICAL SOCIETY.

THURSDAY, JUNE 20.

Dr. WARREN DE LA RUE, F.R.S., President, in the chair.

IN continuation of our report of this meeting we have yet several communications remaining to be noticed.

Professor J. A. WANKLYN read a paper on "*Water Analysis; Determination of the Nitrogenous Matter*," of which Messrs. E. T. Chapman, Miles H. Smith, and himself were joint authors. Referring to the present unsatisfactory state of our knowledge respecting the decompositions and mode of detection of organic matters (and particularly those of animal origin) occurring in potable waters, the authors quote experiments which tend to prove that, by the evaporation test, the quality of an identical (bad) sample of water may appear widely different according to the rate of evaporation and the manner of applying the necessary heat in the process of analysis; and, further, when a sample of water containing urea or other sewage products, is diluted with a known proportion of distilled water the indication of impurity is not diminished in the ratio anticipated. Extracts from the Report on Metropolitan Waters by Drs. Hofmann and Blyth, 1865, and from the Discourse on Potable Waters delivered last year by Dr. W. A. Miller were read as authoritative admissions of this and similar practical difficulties. The authors further state that no reliance can be placed on Pugh's method of estimating nitric acid as ordinarily performed, and that ammonia cannot be determined in waters containing nitrogenous organic matters by any process involving the boiling with an alkali.

Direct experiments were made upon known quantities of urea, albumen, and gelatin dissolved in water, and the singular fact was disclosed that, whilst the first of these bodies is completely changed into ammonia by boiling with *carbonate of soda*, the two latter substances resist decomposition until *caustic soda* (or potash) is introduced, when *one-third* of the nitrogen contained in them is evolved in the form of ammonia. The remaining *two-thirds* of this constituent are finally liberated in the same form upon adding some crystals of the permanganate of potash and continuing the distillation. The authors employ Nessler's test for indicating the proportion of ammonia originally contained as such in the water, as well as that subsequently formed, and they rely upon the before-mentioned ratio as confirmatory of the existence of the nitrogen in this most objectionable albuminoid form. The details of operating are minutely described in the paper, and several examples are given by way of showing the application of the process. Thames water collected at London-bridge on June 18, tide two hours' flood, contained—

	Grains per gallon.
Ammonia (ready formed)	·0980
Urea	·0889
Albuminous matter (equivalent to white of egg)	·8820

Other results are quoted for East London water, New River, Lambeth and Vauxhall, and water taken from the pumps in Berkeley-square and Bishopsgate-street.

The PRESIDENT inquired the reason of its being found necessary to determine the ammonia separately in the distilled products obtained in the second and third stages of the operation. Why not mix these together and proceed to estimate at once the whole of the nitrogen existing in the organic form?

Professor WANKLYN, in reply, said this course might be adopted, but he considered that a valuable indication towards fixing the nature of the nitrogen was obtained by their separate examination, and this did not in practice occupy a longer time.

Dr. THUDICHUM offered some remarks on the probable applicability of this process to the examination of the "rice-water" evacuations in cases of cholera.

Mr. DUGALD CAMPBELL said that his experiences were not in accordance with the statement just now made by Professor Wanklyn. He found that a solution of gelatin invariably gave off part of the nitrogen in the form of ammonia even upon distillation with carbonate of soda, and the results in the case of urea were not decisive, since it required an addition of caustic alkali before all the ammonia resulting from its decomposition could be expelled. Permanganate of potash had been tried by the speaker in the examination of abnormal excreta obtained in a diabetic case, but neither this agent alone, or aided by the addition of the caustic alkali, sufficed to liberate the whole of the nitrogen even when the heat applied was so great as to cause the destruction of the glass vessel.

Mr. E. T. CHAPMAN remarked that when the amount of albumen or gelatin operated upon was found considerable, it was necessary to fill up the retort once or twice with pure water, otherwise the whole of the ammonia could not be obtained by distillation. This precaution might even be required in the examination of any impure water.

Dr. COOK made a short statement in general confirmation of Mr. Campbell's remarks.

The SECRETARY then read a paper entitled "*Analysis of a Biliary Concretion, and on a New Method of preparing Biliverdine*," by Dr. T. L. Phipson. The concretion was found in the liver of a pig, and was of considerable size, being about 3 by 2 inches, and of a yellow, waxy appearance. In the natural state it contained 37 per cent of water, but after pulverisation and exposure to air it lost all but the 8 per cent shown in the analysis. Duplicate determinations were made of most of the constituents. The gall-stone had the following composition:—

Water	8·00
Cholesterine	1·35
Mucus	11·50
Hyocholate of soda, with some hyocholic acid and hyocholine	2·75
Cholepyrrhine	61·36
Carbonate of lime	1·55
Phosphate of lime	3·25
Soda	1·11
Chloride of sodium	7·13
Caprylic acid, matters not determined, and loss	2·00
	100·00

The principal constituent is the yellow colouring matter, cholepyrrhine (or bilipheine); this, on digestion with alcohol acidulated with hydrochloric acid passes into solution as biliverdine, which has a bluish-green colour, and may be separated on addition of water. The author's experiments have led him to believe that there is a close analogy between the yellow and green colouring matters of leaves and the bilipheine and biliverdine derived from animal sources. The last named body is said to differ from chlorophyll only by the elements of two equivalents of carbonic acid.

Dr. THUDICHUM said that the occurrence of gall-stones in the pig was exceedingly rare. He regarded the analogy or identity of chlorophyll and biliverdine as altogether impossible, these substances showing great differences in their optical properties as well as in their composition.

A paper, by Dr. Stenhouse, "*On the Action of Chloride of Iodine on Picric Acid*," was next read. Referring to a previous communication to the society in which the ultimate products of this action were stated to be chloropicrin and chloranil, the author has now investigated the intermediate products which could not formerly (from the manner of conducting the operation) be isolated. Three parts each of water and picric acid, together with one part of iodine, were introduced into a digesting flask through which a current of chlorine was passed, whilst the contents were maintained at a boiling temperature for several hours, and until red nitrous fumes commenced to

appear. The chloride of iodine was then distilled off and the residue in the retort heated with boiling water, from which, on cooling, crystals of dinitro-chlorophenic acid separated out. Analyses both of this acid and of the silver salt were made. Its formula ($C_6H_3Cl[NO_2]_2O$), and all its properties coincide with those observed in the product obtained by Griess when acting upon chlorinated phenol with nitric acid.

Dr. Stenhouse treated *Styphnic Acid* in a similar manner, but this gave only chloropicrin and carbonic acid, thus adding further support to a previous statement of the author "that styphnic acid is not, as Erdmann erroneously supposed, merely an oxidated picric acid, but it must have a different nucleus."

The Secretary then gave a short account of a paper, by Mr. Henry Bassett, "*On Julin's Chloride of Carbon.*" Dr. Hugo Müller obtained, in 1864, a white chlorinated product by the action of pentachloride of antimony upon benzol, and gave to it the formula C_6Cl_6, suggesting its identity with the chloride of carbon of Julin, to which Berthelot ascribed the doubtful formula $C_{10}Cl_{10}$. Mr. Bassett has now reproduced Dr. Müller's body by passing chloroform vapour through a red hot porcelain tube. It crystallises in long colourless needles, which are fusible at 231° C., and the vapour density and analytical results were found to correspond to the formula C_6Cl_6.

The President then adjourned the meeting until November 7, as already announced.

ROYAL INSTITUTION OF GREAT BRITAIN.

A COURSE OF FOUR LECTURES ON

SPECTRUM ANALYSIS, WITH ITS APPLICATIONS TO ASTRONOMY.

By WILLIAM ALLEN MILLER, M.D., F.R.S., &c.

Lecture III.

Solar spectrum—Methods of observation—Constituents of the solar atmosphere—Spectra of the moon, and of the planets, comets, and meteors.—Inferences.

We approach to-day the most difficult, and what may probably be considered the most interesting part of the subject which I have undertaken to bring before you—the application of the principles of spectrum analysis to the examination of the condition of the heavenly bodies. Our attention will be specially directed to the sun and some of the bodies of the solar system.

In order that I may do this with effect let me briefly recapitulate the principle facts which I have to make use of—facts which I have endeavoured to bring before you experimentally in the last two lectures.

We shall have to-day to examine the third of the classes of spectra represented in the diagram—continuous bright spectra crossed by dark lines. Now it will be remembered that every gaseous body at a sufficiently elevated temperature, has a specific spectrum. That spectrum may have its brilliancy increased as the temperature rises, and it may have new lines brought out, but it does not lose lines which it exhibits at a lower temperature. We saw that compound bodies, when sufficiently heated, were separated into their components, and that such compound bodies under those circumstances gave rise to the special spectra of their components. In many cases some of these components are of a nature which give feeble spectra, consequently the spectra of these bodies may entirely disappear from the image projected upon the screen, although the spectra of the other constituent is exceedingly plain. Spectra of the transparent elementary gases in particular are amongst those which disappear under those conditions, such as oxygen, nitrogen, and the permanent gases generally. In one or two instances, elevation of temperature brings out in these gases, spectra which differ from those produced at lower temperatures. A new spectrum is indicated at the high temperature, which was not previously discerned. It is supposed that in these cases the change in the spectrum is accompanied by a change either in the chemical or the molecular constitution of the body by which that change is manifested.

Let me now remind you of an experiment which I showed in the first lecture, where we transmitted the light of the charcoal points through the vapour of sodium; but it will depend upon the relative temperature of the two spectra what the effect shall be. If the vapour of sodium is at a considerably lower temperature than the body behind it, which is giving the continuous spectrum, sodium vapour in this case absorbs rays corresponding in the frequency of their vibration to its own. The temperature of the sodium being only slightly raised, the light which it emits will be a little greater than that which the sodium alone would have produced, but it will be considerably less than that which would be produced by the portion of the continuous spectrum, behind, which it has absorbed; and the result is that when the image of this sodium light is thrown upon the screen, instead of having a bright line, we obtain a black line, or what appears to us a black line, that black line being really a line of low illuminating power contrasted with the spectrum of high illuminating power, and therefore producing upon our eyes the impression of a black line. The intensity of that black line will vary with the difference between the temperature of the body behind and that of the sodium by which the absorption is effected.

If the sodium be raised in temperature until it acquires the same degree as that of the body behind it, the light which falls upon the sodium will be absorbed as before; but now as the intensity of the sodium light itself is equal to that of the incident light, we shall have no sensible effect produced. Therefore the spectrum which falls upon the screen will be continuous, if the sodium be at the same temperature and equally luminous with the portion of spectrum which falls upon and is absorbed by it. But if, on the other hand, the sodium be still hotter, and be still more intensely luminous than the body behind it, it will now in its turn predominate, and instead of a black line we shall have a bright line, or a line of increased brilliancy.

Now I wish you specially to bear in mind these three conditions, which may be produced by the incandescent sodium vapour. 1. We may have a black line when the temperature of the sodium is low; or, 2, we may have no sensible effect, in which case the temperature and the light of the sodium are equal to those of the incident light; or, 3, we may have a bright line, in which case the temperature of the sodium and its light are considerably greater than those of the incident light. What is true in these respects of the vapour of sodium is also true of the vapours of all incandescent bodies. We shall see the application of these points very shortly.

Before we go directly to the consideration of the solar spectrum, let us endeavour to acquire some notion, if we can, of this vast centre of force upon which we are dependent every instant of our lives, and upon which the whole frame around us is dependent for the maintenance of its energies.

The sun, then, we must remember, is a vast body at the distance of 95 millions of miles from us, or perhaps a little less, a globe the visible disc of which is about 880,000 miles across. This wonderful globe is continually throwing forth an amount of light and heat in all directions into space. Of that light and heat we at any given moment are never receiving more than about a 2,300 millionth part: all the rest is passing into space, here and there intercepted by other planets and by other suns. But the vast mass of the light and of the heat which is being given forth from the sun is radiated into space. What becomes of it? That is a question which no one has answered, and no one can answer in the present state of our knowledge. Let us further consider that this vast globe is maintained in a state of intense incandescence. We have now to inquire whether we have any means of

ascertaining what the cause of that incandescence is; and if we do not reach so far as that, have we any means of ascertaining the composition of the matter which is in this wonderfully active state?

In an inquiry of this kind every aid that is at our command must be pressed into the service. The appearance of the sun, when viewed through a telescope, manifests to us the fact that the solar surface is in a perpetual state of violent agitation. It is not a smooth glowing mass of molten iron—nothing of the sort, for we can see that at different points upon the surface of the sun there are differences in the degrees of activity, and differences in the amount of light which it is giving out. The surface of the sun on the whole may be considered as made up of a series of what have been called bright granules, the forms of which have been variously described by different observers according to the powers of the instruments applied. But these bright granules, be it remembered, represent masses hundreds of miles in diameter. The distance of the sun is such that a circle, a single second of arc in diameter, which, according to Sir John Herschel, is the smallest surface we can see, is 467 miles in diameter. These masses of luminous matter are diffused over the the surface of a substance which is much less luminous than itself. Upon the surface of the sun there are dark points which have been called *pores*. In addition to these appearances we have evidence, at intervals, of vast tornadoes or storms which appear to be taking place in this undulating luminous atmosphere. This luminous atmosphere of the sun, or photosphere as it is frequently called according to Sir John Herschel, is best conceived to consist of a quantity of very finely divided, highly luminous, cloudy matter in suspension in a transparent, slightly luminous body of air, differences in luminosity depending upon differences in the distribution of this suspended matter. I am very far from saying that this condition is maintained by an ordinary process of combustion. But I believe there is nothing which gives us a better notion of what the luminous particles of the sun may be, than is afforded by examining the product obtained when a substance is burned in oxygen, like phosphorus, which gives out a quantity of solid flocculent phosphoric acid, glowing with an intense white light by the heat evolved during combustion. The suspended matter in the sun is possibly liquid, but probably solid particles, which are deposited in this intensely-heated, but not highly luminous atmosphere, in large cloud-like masses, these masses perpetually sinking to a lower level and as continually being raised again by currents in the solar atmosphere. In order to interpret these appearances we must call to our aid every fact that we can ascertain with regard to the physical condition of the sun. We must apply the laws of physics as we have ascertained them upon the earth. We must invent no new ones to explain these phenomena, if we would proceed in the true path of philosophical inquiry.

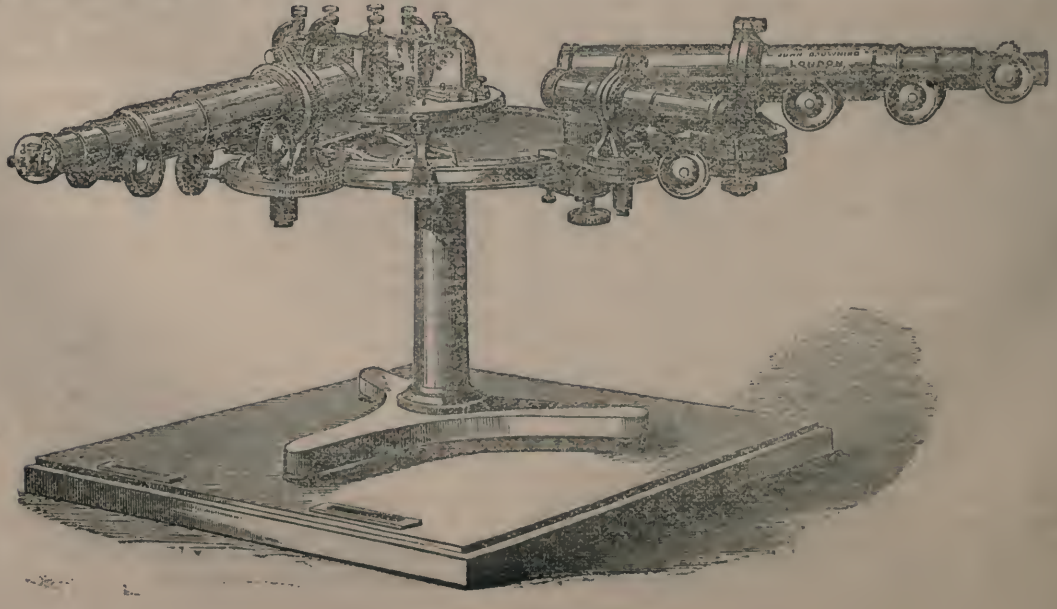
Supposing, then, the whole disc of the sun were filled up with matter of uniform density (a very violent supposition, I grant), it must be borne in mind that the mass of the sun, taking that portion of it which we see as its luminous disc, would be represented by a mass of matter a little less than half as heavy again as water. Again, we must remember that the effect of gravity upon the surface of the sun far exceeds its power at the surface of the earth. A pound weight upon the surface of the earth would gravitate upon the sun's surface with the force of a quarter of a hundred weight, so that at the surface of the sun the effect of gravity, like that of many forces in operation upon the earth's surface, is exaggerated to a wonderful extent.

Besides these bright granules, lying between which are the dark pores or spots producing what we may regard as the ordinary appearances, we have upon the surface of the sun, as already stated, evidence of what appears to be be violent tornadoes. The luminous mass which constitutes the photosphere of the sun is from time to time apparently torn up, and thousands, aye, hundreds of thousands of square miles of its surface are tossed aside, and a vast cavity is formed in this luminous mass. I am not saying this without warrant derived from observations upon the sun's spots, first made nearly a hundred years ago by Professor Wilson, of Glasgow, and since confirmed in a remarkable manner by the investigations which have been made since the state of the sun has been more minutely examined in modern times. The most recent examinations of this description are due to our countrymen De la Rue and Stewart, aided by Mr. Löwy. Their investigations shows us that these vast craters in the luminous surface (if the expression may be allowed) consist of two principal portions, the margin consisting of a faintly shaded portion, the *penumbra*, with a dark spot, the *umbra*, in the middle. One of the enigmas for solution is to explain what these solar spots are. Has the photosphere been heaped up to form the adjacent brilliant streaks known as *faculæ?* and are these dark spots clouds of colder material which have been depressed into the photosphere, and which gradually disappear in consequence of the incandescent portions gradually again raising the clouds to their usual temperature? Are they—and I think here the evidence goes against this—are they holes in this luminous photosphere showing behind it a dark mass—the interior of the sun itself? I cannot now, however, go more minutely into the question of sun-spots, as it would be foreign to my purpose. My object is to prepare your minds by bringing before you some of the principal points in the physics of the sun, which have been ascertained from different sides by investigating the recent additions to our knowledge by the spectrum. I shall, therefore, simply now give you on the screen a representation of a photograph of the surface of the sun itself, which, it will be recollected, will be a reversed image of the sun; that is to say, where the sun is brightest we shall have in the photograph the greatest diminution of brightness. At the upper part of the disc you see a brilliant spot. That is a very characteristic sun-spot. Remembering that the most brilliant part of the screen is that which is really the darkest on the sun, you will observe in the centre of the opening the umbra of the spot. Then around that is what is called the penumbra, or more slightly shaded portion: on the other side are groups of spots which are in the process of formation or of healing up, for I do not know at what period this particular spot was taken. These cross lines on the photograph are merely lines of position showing which way the sun is moving. The spots cross the disc of the sun from left to right, and as they gradually diminish it is always found that the umbra is the first portion which disappears.

I wish, in the next place, to show you another fact connected with the sun, which recent observation has enabled us to ascertain. The sun is not simply a great glowing ball, such as it looks to us, but there is something outside the sun of which we in general take no notice, and of which until some twenty or thirty years ago we were in absolute ignorance. The phenomenon to which I am going now to direct your attention is only visible on those rare occasions when the disc of the sun is obscured by the passage of the moon between us and its body. In those cases, and under suitable conditions, we have an opportunity of ascertaining that the sun is surrounded by a vast atmosphere which is not in that intensely glowing and incandescent condition which the surface that we usually see is. I have here a photograph which represents an observation made by Mr. De la Rue in July, 1860. [The photograph was introduced.] This indicates to us the appearance which is seen when the whole disc of the sun, which is visible under ordinary circumstances, is entirely eclipsed by the moon. You will notice that round the dark body of the moon we have a remarkable halo of light, and that this halo is at certain points much more brilliant than at others,—that, in point of fact, there are clouds thrown up into this atmosphere. Some of these

clouds have been seen detached from each other. It is estimated that the height at which these clouds occur is in some cases at least 72,000 miles from the surface of the sun, so that around the sun there is a vast atmosphere invisible under ordinary circumstances, into which invisible atmosphere are projected what you see here, and what have been called red flames, clouds, probably, of incandescent matter. In this photograph the solar atmosphere is all of one uniform tint, but as actually seen, its projections, instead of being white, are of a rich red colour, and possess considerable photographic power. What the nature of these flames may be is a point on which further inquiries are necessary. It is probable that next year there will be an opportunity of making observations upon them under conditions more favourable than have ever existed since attention was directed to these points, for in the month of August there will be a total eclipse of the sun, visible in the central portions of India, which will have the unusual duration of nearly five minutes. Thus, if the atmosphere is favourable, opportunity will be given to persons properly prepared for making observations upon these flames by means of the spectroscope, and thus probably of ascertaining what the constituents are.

I will now endeavour to explain how the spectroscope will act in determining the character of these flames, and how it has enabled us to ascertain what some of the components of the sun are. We are indebted for our great stride in this direction to the observations and discoveries to Kirchhoff. Let me call your attention for a few moments to the diagram which we have here, which is intended to represent certain appearances exhibited by the solar spectrum. Suppose the light to be admitted through a vertical slit at a distance, if it be viewed after it has passed through the prism, the spectrum so obtained will be seen to be crossed by an almost countless number of dark lines. I am not sure whether these dark bands were not first observed in this very Institution, but at any rate the observation was first made by one of its most distinguished members, Dr. Wollaston. The importance of this observation was certainly not anticipated at the time it was made. He merely looked at the light coming in at the chink of a door, through a prism which he held up to his eye. Some twelve years afterwards Fraünhofer examined the solar spectrum by viewing the slit, which he placed at a distance of 24 feet from him, through a very clear prism and by means of a telescope. He then saw not merely eight or ten bands, as Dr. Wollaston had done, but he mapped and measured nearly 600 of them, and these lines have been called after him "Fraünhofer's lines." In the diagram you see a number of letters which run along the bottom. These letters were appropriated by Fraünhofer to the indication of the most important and most prominent of the lines which he observed. Fraünhofer found that the solar lines are perfectly fixed in position in different colours, and, being an optician, he applied this observato the purpose of determining the refractive power of the glass which he used in his lenses and prisms. These lines have always been designated by the letters which Fraünhofer gave them. Many persons have since carefully examined the solar spectrum, and some have described and mapped additional lines. Though I cannot here go into the history of this matter, I may mention particularly the names of Angström and of our own countryman, Sir David Brewster (who has latterly worked in association with Dr. Gladstone): above all we are indebted to Kirchhoff. He used an instrument exactly similar in principle to that which I described in the last lecture, the only difference being that, instead of taking a single prism as is represented in the diagram, he made the light pass through three additional prisms. The light was thrown upon his eye by a telescope. By the kindness of Mr. Gassiot I have an opportunity of showing you what I believe to be the finest instrument of the kind which has ever been constructed. It was made by Mr. Browning, and the accuracy and the workmanship have been attested by all who have used it. In this instrument the light is allowed to fall upon a battery of nine prisms, and after passing out through the last prism, it falls upon the face of the telescope. through which it is viewed by a person at the other extremity. It is clear that if we transmitted the sun's rays through such an instrument they would be opened out by the successive action of the prisms, until each line was brought out in such a way that the character of that line could be ascertained with the greatest nicety. Kirchhoff carefully mapped all these lines between A and G. They vary greatly in their strength and degree of definition. This is a curious, and at the same time an important point, and as will be seen it may be made use of in order to enable us to ascertain the origin of the lines in certain cases. As I cannot project the lines of the solar spectrum itself upon the screen, I will substitute for it a photograph of Kirchhoff's map. It is a beautiful map, but



there is considerable difficulty in rendering such fine lines visible to a large audience. [The representation of the map was produced on the screen.] You see how very greatly the lines vary in thickness, in blackness, and in definition. Some of them are as sharp as a line can be drawn, while others are broad and confused and somewhat indefinite in their outlines. Hence it is evident that these lines possess a sort of character by which they can be recognised when they are again rendered visible.

[The attention of the audience was then directed to the character of certain groups of lines, particularly in the vicinity of the lines D and C.]

Before I quit this part of the subject I shall call your attention to a beautiful photograph which indicates the exact position of these lines, as produced by the action of the sun's rays upon a collodion plate. They were taken in New York by Mr. Rutherford, from whom I received the specimen before you. When compared with Kirchhoff's maps, it is wonderful to see how perfect is the correspondence, and how faithfully those maps represent the actual lines.

I once more project the map upon the screen, for the purpose of calling your attention to the green portion. There are three lines in the green due to magnesium. Underneath this map you will see a number of letters. For example, here are the letters Fe. That is a contraction for the Latin *ferrum* (iron), and it shows that every one of these lines so marked corresponds with a bright line in the spectrum of iron. There are a number of other bodies indicated in the same way; thus, Ni signifies nickel; Ca, calcium; Cd, cadmium; Au, gold. Not that every one of these metals has corresponding lines in the solar spectrum, but Kirchhoff has examined the bright lines produced by these different bodies, and has marked the position of the solar spectrum to which these lines correspond.

I will show you now the blue portion of the spectrum which is beyond the parts at which we have just looked. This black line is Fraünhofer's line G. You see what dark groups of lines there are in this part of the spectrum. Each of these lines has its own meaning, if we can only succeed in determining it, though in many cases this has not been done.

(To be continued.)

ACADEMY OF SCIENCES.

June 24, 1867.

(From our own Correspondent.)

M. Chevreul, president, read a letter from the Minister of Public Instruction announcing to the Academy that the election of M. Yvon de Villarceau in the section of Geography and Navigation was approved by an Imperial decree of the 19th June.

M. Elie de Beaumont read a letter from M. Agassis, dated last November, in which this *savant* gives details on his voyage up the river Amazon and its tributaries. He has found that that part of the American continent is formed of mud or diluvium resting on a cretaceous deposit, similar to the basin of the Seine or banks of the Somme.

M. Rouget addressed a memoir in which he differs from the opinions lately put forward on muscular contraction.

M. Thomas gave a paper on cholera remedies.

M. de Paravay, on ancient Chinese books.

M. Edward Robin, on the length of life.

M. Clausius, now in Paris, presented a copy of his work on the "Theory of Heat."

M. Velpeau sent a note by Trubart on a new mode of the introduction of medicaments. He had only made a small number of experiments, which he communicated in order to take date. For cephalalgia, opthalmia, &c., he uses remedies introduced by the nostrils.

M. Charles Deville communicated the observations made by M. Janssen on the eruption of Santorin, and submitted the flames to spectrum analysis. The results are, the presence of sodium in abundance, carbon, chlorine, and copper. Experiments made on Stromboli gave the same results.

M. Balard presented the work of M. Friedel on silicates and other chemical products.

M. Jules Pernot, of Avignon, sent a note on the preparation of silicates and other chemical products. He has obtained a first-class material for calico printing, &c.

M. de Pambour read a paper on hydraulic machines.

The Academy named two commissions, one for prizes for statistics and another for the Bordin prize.

M. Artur gave some explanations of his theory of the molecular actions, capillary attractions, and chemical decompositions.

M. Zalewski read a note on the method of augmenting the power of the Bunsen pile.

M. Caron criticised the artificial processes for preparing substitutes for milk, and concluded by pronouncing them indigestible and injurious to infants.

M. Daubrée read a note of M. Bonafous on the meteor seen on June 11, at 8h. 25m.

NOTICES OF BOOKS.

MINERALOGICAL PAMPHLETS.

An Index to Mineralogy. By T. Allison Readwin, Readwin, F.G.S., F.S.S., &c. London: E. and F. N. Spon, Charing-crass.

Royal Agricultural College, Circncester. A Guide to the Chemical Department of the College Museum. Part I. The Mineral Collection.

Sketch of the Mineralogy of Nova Scotia, as Illustrated by the Collections of Minerals sent to the Paris Exhibition, 1867. By Professor How, D.C.L., University of King's College, Windsor, N.S. Published by authority of the Commissioners for Nova Scotia.

Mr. Readwin, in the preface, states that the list is obviously imperfect, and that he hopes it will elicit correction at the hands of chemists and others. The index is a list of some 2,500 minerals, with synonymes, the constituents expressed by contractions in a small space, and the number of the case in the British Museum containing specimens. We take an example showing the method Mr. Readwin employs:—

"Eulysite (chrysolite) Mg. Sil. B. M. 36 (var. Olivine).

By an explanation at the commencement of the book the student finds eulysite to belong to the same species of mineral as chrysolite. The remainder of the information with regard to the mineral is evident at once.

It is a little work which will be appreciated by those interested in mineralogy.

The aim of the writer of the second pamphlet—Professor A. H. Church—is merely to describe the more important minerals to be found in the museum. There is no attempt at being encyclopædic. The minerals are classed under six divisions, and the most important mineral species belonging to each division are pointed out. The information is given in a very clear and concise manner, and were it not published in the form of a guide, we should be inclined to call it brief to a fault.

It is stated by Professor How that the collections of minerals made on the present occasion are sufficient evidence that the mineralogy of Nova Scotia is very interesting both from a scientific and an economic point of view. In the first place gold is obtained in considerable quantity. Very valuable iron ores are also worked, ores yielding bar iron which ranks with the finest Swedish metal for making steel. Ores of Manganese are worked, and the value of that sent from Teny Cape up to the present equals £8,000 or £9,000. Wad, manganite and pyrolusite are exhibited. Native copper and other ores are to some extent worked. A variety of copper ores are are exhibited, copper pyrites, cupiferous oxide of iron.

Galena is also represented from several localities. Mispickel is also exhibited from three or four localities, and is sometimes found in large amount; cobalt occasionally occurs with it. Barytes occurs in some places in sufficient quantity to be exported. Gypsum exists in inexhaustible profusion: natroborocalcite, and a mineral containing 59 per cent of boric acid—cryptomorphite—have been found embedded in it. Both are exhibited. Anhydrite occurs in quantity. Other products are marble, limestones, granite, sandstone, &c. The author, we think, certainly proves his opening statement.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Tungsten, properties and compounds of, (O=8)—E. Zettnor. The best method of preparing pure compounds of tungsten, from the mineral, is to fuse the latter with ½ of its weight of sodic carbonate. The fused mass is extracted with boiling water, which, on evaporation, yields crystals of the neutral sodic tungstate, NaO,WO_3+2 aq. The mother-liquor, acidulated with nitric acid and evaporated, gives crystals of the acid salt, $NaO, 7WO_3+16$ aq.

The quantitative determination of tungstic acid may be effected by adding a standard solution of plumbic acetate to an aqueous solution of tungstic acid, acidulated with acetic acid. The results are very accurate.

The atomic weight of tungsten has been deduced from the composition of ferrous and argentic tungstate; the first gave the number 92·038, the latter 91·927. Mean = 91·976 or 92.

Metallic tungsten is obtained as a dark grey powder, by melting tungstic acid together with sodium, under a cover of sodic chloride, or by passing a strong electric current through fused sodic tungstate.—(*Pogg. Ann.* cxxx. 16.)

Lead-chamber Process.—R. Weber. Sulphurous acid, in presence of much water, reduces binoxide of nitrogen to oxide of nitrogen. Sulphuric acid, of a certain strength, prevents this reaction. This explains the loss of nitric acid in the manufacture of sulphuric acid, which always takes place when the sulphuric acid in the lead-chamber is below the normal strength.—(*Pogg. Ann.* cxxx. 277.)

Fluorides of Antimony and Arsenic.—Marignac. Fluoride of Antimony forms an amorphous, gum-like mass, when evaporated in vacuo. Its concentrated solution cannot be heated without decomposition. If potassic or sodic hydrate, or ammonia, be added to a very concentrated solution of the fluoride, double fluorides in crystals may be obtained. They are nearly all deliquescent, and their solution is not immediately precipitated by sulphuretted hydrogen, acids, or alkalies. They are stable in the crystalline state, but decompose in solution, forming oxyfluorides.

The corresponding fluo-arseniates are still more difficult to obtain in crystals. Sulphuretted hydrogen decomposes their solution slowly.—(*Arch. Science.*, 1867.)

Dissociation.—H. Debray finds that the phenomenon of dissociation may be observed in solid bodies which are formed by direct combination of a volatile and a non-volatile body.

Pure Iceland spar was heated in a tube, which could be exhausted, or filled with any gas by means of a Geisler's mercury air-pump. At 350°C the decomposition of the mineral was zero; at 440° scarcely perceptible, at 860° very distinct, but ceased when the pressure in the tube amounted to 85 mm. Heated to 1070° the pressure became stationary at 520 mm. This "tension of dissociation" is constant at a given temperature, increases with the rise of temperature, and is independent of the extent of decomposition the carbonate has undergone. If in these experiments the apparatus, after having been heated, is allowed to cool, the generated carbonic acid is entirely reabsorbed, and a vacuum again produced. The author further finds that caustic lime, at ordinary temperatures, does not absorb a trace of carbonic acid, if the latter be perfectly dry; the absorption begins at a dark red-heat.—(*Comptes R.* lxiv. 603.)

Hydriodic Acid, action of heat on.—T. Hautefeuille. Hydriodic acid, if gradually heated, begins to decompose at 180°C, the violet colour of the gas increasing slowly up to 440°; but from 440° to 700° the decomposition proceeds rapidly. The amount of decomposed gas varies with the extent of surface. At a given temperature it is greatly increased by spongy platinum, but the latter also causes hydrogen and iodine to combine. If, at a certain temperature, equal volumes of H and I pass over platinum in the finely divided state, the quantity of the gases remaining uncombined is exactly equal to that which would be formed by decomposition, if hydriodic acid had been used. (*Comptes R.* lxiv. 608.)

Ethers of the Acids of Arsenic (C=12).—T. M. Crafts. The reaction of silicic ethide on boric acid, studied by Friedel and Crafts, in which ethylic borate is formed, has been tried by the latter chemist with the acids of arsenic, but only arsenious acid behaves like boric acid. The action of dry arsenic acid upon silicic ethide takes place under pressure at 220°=230°C, silicic acid is precipitated, and a gas escapes which seems to be ethylene. On distillation, arsenious ethide is obtained. The residue consists of arsenious acid, silicic acid, and some arsenic acid.

Arsenic ethide, $3(C_2H_5)AsO_4$, is formed by heating ethylic iodide, diluted with twice its volumes of ordinary ether, and argentic arseniate, slightly in excess, together in sealed tubes to 120°C. The contents of the tube are extracted with ether, the ether evaporated in a current of carbonic acid, and the remaining liquid distilled under diminished pressure. Under ordinary pressure, arsenic ethide boils at 235°—238°, but decomposes partially. Its sp. gr. at 0°C is =1·3264. It mixes with water in every proportion, showing then all the reactions of arsenic acid.

Arsenious ethide $3(C_2H_5)AsO_3$, is produced on heating silicic ethide with arsenious acid to 220° under pressure. It boils at 166°—168°. Its vapour density was found ranging from 7.197 to 7·615, according to the temperature at which it was taken; theory requires 7·267. Its sp. gr. at 0°C is =1·224. Water decomposes it.

The ether may also be obtained from argentic arsenite with ethylic iodide.—(*Comptes R.* lxiv. 700.)

Aromatic Hydrocarbons converted into Phenols (C=12.)—A. Wurtz. Sulphobenzolic acid and its analogues, melted with potassic hydrate, (250°—300°C), splits up into sulphurous acid and the respective phenol. The phenols thus obtained are very pure. The reaction takes places according to the following equation:

$$SO_2\begin{cases}C_6H_5\\OK\end{cases}+KHO = SO_2\begin{cases}K\\OK\end{cases}+C_6H_5OH.$$

—*Comptes R.* lxiv. 749.

Crystallizable Sugar in Helianthus Tuberosus.—Dubrunfaut. The juice of the tubers of the Jerusalem artichoke, if gathered in September, contain inulin in large quantities; if reaped in March or April, it is found to contain dextrose and a non-crystallisable, inactive sugar instead. These two saccharine matters are, no doubt, produced by the conversion of the inulin, which is formed during the first period of vegetation.—(*Comptes R.* lxiv. 764.)

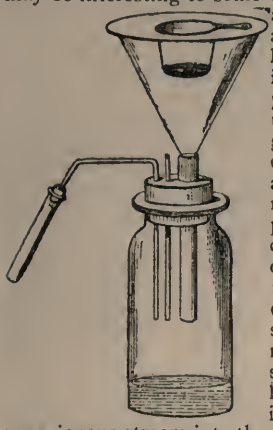
Phenol, derivatives of.—H. Brunk has prepared a series of substitution-compounds of phenol, especially those containing nitryl and bromine together. Their salts crystallise well. He also describes the methylic ethers of the two isomeric nitrophenols, which he finds to be identical with mononitranisol and isonitranisol. The first is an oily liquid, the latter a crystallizable body. Both exchange their nitryl for amide on reduction with tin and chlorhydric acid. The monamidophenylmethylic ether (anisidin) is a liquid, the isamidophenolmethylic ether (isanisidin), a solid.—(*Zeitschr. Chem. N. F.* iii. 202.)

CORRESPONDENCE.

A LECTURE EXPERIMENT.

To the Editor of the Chemical News.

SIR,—The following simple apparatus which I contrived lately for illustrating the manufacture of sulphuric acid, may be interesting to some of your readers. Three tubes are passed through the cork of a wide-mouthed bottle, the largest being connected by an india-rubber junction with a pint funnel, and the small one to the left with a test-tube generating NO by means of copper turnings and nitric acid. The middle tube admits air. A little water is poured into the bottle first, to combine with SO_3 for the production of H_2SO_4. The funnel is covered in with a metal cap to which a small pan is suspended. This pan is a miniature furnace. A bit of sulphur is placed in it and lighted. The fumes of SO_2 immediately flow down in a conspicuous stream into the bottle. Here they encounter NO, and the usual reaction takes place. Any SO_2 which the water may dissolve is expelled by boiling, when the solution answers to all the tests for the presence of sulphuric acid. An extra cover which slides on the metal lid, conceals some air-holes, useful at the begining of the experiment. Hoping this modification of the apparatus described by Miller for a similiar purpose, may be acceptable as an exact and economical imitation of a most interesting manufacturing process,



I am, &c., E. S.

Nottingham, June 6, 1867.

EXTINCTION OF FIRES.

To the Editor of the Chemical News.

SIR,—Will you allow me to make a few remarks respecting a fire which took place the other day in an oil distillery at Hackney Wick? I happened to be passing at the time, and watched the progress of the flames. We all know that from whatever cause a fire takes place, water is rushed to for putting it out. In the case I refer to, the place was, as usual, drowned with water, which merely had the effect of spreading the flames and increasing their intensity, for the oil burned until there appeared to be nothing left to support the flames. Now my reason for sending you this letter is to point out how easily this fire might have been put out if a simple plan, which I shall mention, had been adopted, and there is no doubt that many similar fires could be extinguished by the same means. At the fire referred to I noticed the flaming oil floating on the surface of the water on the floors. The water running down the walls bore a flaming surface of oil likewise. This shows that the water had little or no power over the burning oil.

There was lying near the building in which the fire broke out, a large quantity of sand. Now if half-a-dozen men, provided with spades, had "dashed" a lot of this sand upon the flames soon after the fire was discovered, I have no hesitation in saying that it would have been put out, and but little damage done. But this was not the case, for long before the engines arrived, the fire had got such a hold upon the building and its contents that the firemen's work was little better than labour in vain, for the place was completely gutted. The sudden throwing of sand or any similar substance upon masses of flame proceeding from burning oil, &c., is generally sufficient to extinguish or choke them out.

Some time ago I put out a fire, which might have destroyed an immense amount of valuable property, by simply dashing fifty or a hundred shovelsfull of slacked lime, which happened to be near at hand, upon the flames, which literally choked them out. The fire in this case was caused by a cask of oil being set on fire accidentally. This is only one of the many fires which I have seen put out by adopting the same means. I consider it would be a good plan if owners of such places as oil works, &c., always had at hand a quantity of sand, dry old lime waste, &c., which could be used in the manner I have stated when necessary.

I am advancing no fancy statement, but giving your readers a plan which has been tried with every success, and I could write much in favour of this plan did I think such a course at all necessary.

I am, &c., T. H. SWINDELLS,

July 2. Consulting Chemist.

MISCELLANEOUS.

The Representation of the University of London.—We have been requested to state that amongst the names of those who have been proposed to represent this University in Parliament that of Sir John Lubbock, Bart., F.R.S., has met with many warm advocates. There is no doubt that Sir John Lubbock possesses unusual qualifications for such a task; for, while his intellectual and scientific eminence would give weight to his words on questions of science, of education, and civil polity, his position in the City of London, and his reputation as a man of business, would obtain for him a hearing that might be denied to a man occupied exclusively in scientific pursuits. For the same reason he is peculiarly fitted to be the spokesman in the House of Commons of the large and increasing body of scientific men—a class whose opinions have hitherto found very inadequate expression in Parliament. We have heard the name of Dr. W. Allen Miller, F.R.S., proposed as that of a gentleman also fitted to represent this University, and should Dr. Miller be induced to come forward as a candidate, there is little doubt that he will obtain the unanimous support of the chemical fraternity; but in the event of this rumour turning out incorrect, chemists could not have a better representative than Sir John Lubbock, supported as he is by such well known men as Dr. A. Crum Brown, G. C. Foster, Dr. Odling, Dr. Pye-Smith, and H. Watts.

An American Reprint of the "Chemical News."—An announcement, of which the following is an extract, has been extensively advertised in the New York papers:—"The undersigned have the satisfaction to announce that on the 1st of July next they will begin the publication of an American reprint of the CHEMICAL NEWS AND JOURNAL OF PHYSICAL SCIENCE, the most popular and useful issue of the foreign scientific press. This valuable journal is devoted to . . . . Its foremost rank as the leading representative of these interests is undisputed. . . . . No interested class can now offord to be without this indispensable repertory of practical science. While the reprint, in form, size, type, and engravings will be a literal copy of the original, a change will be made in the time of publication, and it will be published in monthly instead of weekly numbers. Terms ———." Meantime we have forwarded a communication to this enterprising firm which may induce them to somewhat alter their programme.

Suspension of the Storm Warnings.—We have more than once expressed our regret that the scientific committee, which has been appointed by the President and Council of the Royal Society, has advised the discontinuance of the Storm Warnings of the late Admiral Fitzroy. At the last meeting of the Literary and Philosophical Society, of Manchester, the subject was again brought for ward by Mr. Baxendell, who strongly urged that the Board of Trade would again take the management of the Meteorological Department into their own hands, and ap-

point Mr. Babington, or some other competent and responsible person, to resume and carry on the system of storm warnings. As an illustration of the lamentable consequences of the suspension of storm signals, it may be stated that among the wrecks caused by the unusually heavy gale of the 10th of April, there were four vessels, which had sailed from Liverpool just before the commencement of the storm. Three of these vessels had been thrown on the Lancashire coast, and totally lost, and the lives of three of the crew of one vessel had been sacrificed. The fourth vessel had foundered in the Irish Sea, and all hands were lost. Now the meteorological phenomena immediately preceding the occurrence of this storm were of such a nature that there could have been no difficulty in giving notice of its approach in ample time to prevent the sailing of these vessels. In fact, without the aid of telegrams from distant stations, its approach was confidently announced in Manchester, so early as the evening of Monday, the 8th of April, and the direction in which the wind would blow during the most violent period of the storm was also stated at the same time.

The Paris Exhibition.—Mr. Sterry Hunt, F.R.S., the celebrated Canadian Geologist, has been made an officer of the Legion of Honour. Had its acceptance been permitted by our Government a number of honours would have been conferred, on Monday last, upon many English men of science.

The Human Voice.—Dion Boucicault, commenting on the Albert Hall of Science and Art, in the *Pall Mall Gazette*, says:—"The human voice, when speaking with clear articulation and supplied from good lungs, will fill 400,000 cubic feet of air, provided they be enclosed in a proper manner, and the voice placed and directed advantageously. The same voice singing can fill, with equal facility, 600,000 cubic feet. When singing, the vowels are principally used, because it is necessary to dwell upon a note, and we cannot prolong a consonant. In speaking, on the contrary, we depend for articulation on the consonants; but their short percussive sound does not travel. When we shout, or in open-air speaking, which partakes of shouting, we prolong the vowels, drawling the syllable of each word; but what we gain in sound we lose in clearness of articulation; expression is lost in monotony, because its fineness depends on the infinite variety of which the consonant is capable and bestows on the vowel. 2,000 voices, singing or speaking together, travel no further than one voice. They may fill a certain area more completely with that intricacy of waves which, when very troublesome, we call a din; but each voice exerts its own influence on the air, according to its power, and dies away within certain limits. A second voice acts independently, and produces its own separate effect, not fortifying the first, but distinct from it. Aud so with any number of voices—say 10,000—shouting together; if a single trumpeter were placed among them, the note of his trumpet would be heard clearly at a distance where the Babel of voices would have expired in a murmur. Yet, among the din produced by the 10,000 voices, the trumpet would be inaudible. To illustrate this theory more clearly, it is plain that 2,000 persons cannot throw stones further than one person. It is true that the air, within certain limits, will be more full of stones; but they will all come to the ground within a limited area.

NOTES AND QUERIES.

The use of Superheated Steam.—Sir,—About ten years since I carried out a series of experiments with superheated steam, in conjunction with an experienced engineer. In the first instance the steam was applied direct from the boiler at a pressure of 50lbs., and passed through cast iron cylinders, heated to redness, from thence through cap welded wrought-iron pipes, to a cast iron steam jacketted pan or pot (each pot was 1½ inches in thickness, and very strongly bolted together). As soon as the superheated steam passed through the pipes, the gun metal steam taps instantly broke off short owing to the expansion. The stays to the pipes were then removed and the taps replaced. After the superheated steam had been applied to the jacketed pot for upwards of two hours, the interior pot burst from the outer pot at the flange, and was projected through the roof of the building to some considerable distance, and the walls on each side of the building were blown down (the pot weighing about 12 cwt). Some difference of opinion existed . to the cause of the accident, as the steam was not locked in; the at the bottom of the pot was open, and also the valve for the outgoing steam. Perhaps the steam, being highly elastic, could not escape with sufficient rapidity. After considerable experience I have employed superheated steam with great success and most economical results both for dessication and the evaporation of saline solutions, &c. Superheating steam does not require an expensive apparatus; it can be readily accomplished at the back of the furnace of a steam boiler, more especially where Jukes' smoke apparatus is used. A very even temperature can be easily obtained, and in operation it is even superior to Perkins' hot water apparatus, although I have not obtained so high a temperature.—W. H.

Cheap Grease.—Sir,—I am endeavouring to make cheap grease. I have succeeded in making the superior greases. But with the cheapest greases there appears to be a difficulty which I cannot master. They are sold here at 10s. 9s. and 8s. per cwt. These prices are so low that it is to me impracticable to use any other ingredients but rosin, alkali and water. But I find that grease made with these only is sticky and drying, and totally unsaleable. Can any of your subscribers give me an economical recipe for making a good, yet cheap, rosin grease, and greases which will afford a good profit when sold at the above prices?—J. S. W.

To Destroy Ants.—Sir,—Should carbolic acid fail, try liquor ammoniæ fortis: ·880. This is by far the most effective for black beetles.—Q.

Charcoal Biscuits.—Sir,—To make charcoal biscuits, take flour 1 pound; carbonate of ammonia in fine powder, 1½ drachms; white sugar in fine powder, 2 ounces; mix well together—butter 2 ounces; one egg; mix into a stiff paste with new milk, and beat well with a rolling pin for 20 minutes; roll out thin and cut out the biscuits with an inverted egg cup; bake in a quick oven for 15 minutes. Levigated cedar wood charcoal is to be had of Warrick, 3, Garlick Hill, London, and ready made charcoal biscuits of Mr. Bragg, 2. Wigmore Street, Cavendish Square, London.—SUBSCRIBER.

Cure for Dry Rot in Houses.—Sir, I think there is an important oversight in the communication on this subject in your issue of 21st inst. At 27th line, should it not read "*beneath* the joists?" I have a remarkable instance in my mind when asphalt had been applied merely *between* the joists of a gentleman's mansion—these joists or sleepers were supported in the centre and nailed to wooden pegs driven about 18 inches into the soil. In about four years afterwards the whole of the lower apartments were one mass of dry rot, the said pegs having formed excellent conductors. All the woodwork was renewed, and I recommended asphelt to be spread *below, and the sleepers simply to be laid upon the smooth hard surface thus formed.* I believe this has always been effectual. I know a case just now where dry rot has reached the bedrooms.—W. B.

Refrigerating Machine.—Sir,—Is there any manageable machine in use for manufacturing purposes for cooling mother liquors.

ANSWERS TO CORRESPONDENTS.

All Editorial Communications are to be addressed to the EDITOR, and Advertisements and Business Communications to the PUBLISHER, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. Private letters for the Editor must be so marked.

Clericus.—The powder for Larkin's magnesium lamp can be obtained at the magnesium metal company, Manchester; apply to Mr. Mellor, manager.

Querist.—Apply to F. Viewig and Son, publishers, Brunswick, for the works of Baron V. Liebig.

J. F.—The substance is sesquioxide of iron; but whether derived from the pipe or deposited from the water, we cannot say. Is the pipe corroded?

Edward O.—You will be able to obtain all the information you require by applying at the Patent Office, Southampton Buildings, Chancery Lane.

A New Subscriber—Our first volumes can occasionally be procured second hand. Our publisher is sometimes able to secure a set. Leave your name at our office, and state how much you are inclined to give for Vols. 1 and 2.

Dr. A. L. P.—We regret that your communication is too long for our columns.

Carolus.—The acknowledgement was for receipt of money for one year's subscription.

F. Robson.—Pyrophosphate of soda in solution will dissolve sulphur, forming a polysulphide.

F. Huddersfileld.—Scheele's green is arsenite of copper. Schweinfurt green is mixed arsenite and acetate of copper. If chromium green will be bright enough for what you want we certainly advise you to use it in preference.

Communications have been received from W. Briggs; W. Huskisson; Prof. Williamson, F.R.S.; F. Field, F.R.S.; Dr. Odling, F.R.S.; C. Greville Williams, F.R.S.; Dr. R. Angus Smith, F.R.S.; D. Forbes, F.R.S.; C. S. Read; P. Jessop; R. Lowe; C. R. Wright, B. Sc.; John Robinson, (with enclosure); G. F. Rodwell, F.C.S.; E. Kierman, (with enclosure); Alex. Glendining; Professor G. G. Stokes, F.R.S.; Dr. Letheby; G. A. Keyworth; H. Bywater, (with enclosure); J. Wallace; J. H. Swindell; Professor Daubeny, F.R.S.; Joseph Davies, (with enclosure); Edmund G. Tosh, (with enclosure); Lewis Demuth and Co.; J. T. Atkinson; W. Ladd; Hood,

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ANALYSIS OF TINKALCITE—$NaO,2BO_3+2(CaO,2BO_3)+18HO$*—DETECTION OF BORON AND FLUORINE IN MINERALS.

By Professor F. WÖHLER.

After estimating the water of crystallisation, dissolve the mineral in hydrochloric acid, and after neutralising with ammonia, precipitate the lime with oxalate of ammonia. Concentrate the filtrate, and estimate the boracic acid in the state of double fluoride of boron and potassium.

To estimate the soda dissolve another portion of the mineral, precipitate the lime as above with oxalate of ammonia, evaporate the filtrate to dryness, and drive off the ammoniacal salt by heat. Then digest with concentrated hydrofluoric acid, evaporate to dryness, and digest with strong sulphuric acid; all the boracic acid will be carried away in this operation in the form of gaseous fluoride of boron. The sulphate of soda may then be heated to redness in a crucible with a fragment of carbonate of soda.

There are some minerals which contain a rather large quantity of fluorine, silica, alumina and alkalies (principally potash): some also contain soda and lithia, micas for example. Micas being sufficiently heated to disengage fluorine, it must be noticed if they only give off fluoride of silicium, since they contain considerable quantities of silica; the coloration of the blow-pipe flame, however, will suffice to indicate the volatilisation of alkaline fluorides. If this occurs, the best plan to adopt is to perform the experiment just described, replacing the lime by silica; all the fluoride of silicium traverses the silica undecomposed, but the alkaline fluorides are arrested and changed into fluoride of silicium, which is evolved, and into silicates of potash, soda, and lithia, which remain in contact with an excess of silica. Take up the silica by distilled hydrofluoric acid; this will change it into fluoride of silicium, whilst alkaline fluorides remain behind. The alkaline fluorides are treated with sulphuric acid, and changed into sulphates of potash, soda, or lithia, and in this mixture the base is to be sought for.

When the object is therefore to determine the fluorine, one can always estimate the water and the fluoride of silicium alone or mixed.

In the case of fluoride of boron the question is not so simple; on heating, some is disengaged from tourmalines, which contain fluorine and boron. The volatile matters contained in a tourmaline may be determined by a process analogous to that employed in the case of fluoride of silicium; the fluoride of boron being changed into a mixture of fluoride of calcium and boracic acid. Unfortunately we do not know a method of estimating boron in mineral substances, especially if associated with fluorine and silicium; so that if we have fluoride of boron, fluoride of silicium, and alkaline fluorides, we can estimate the alkalies, but not the boron, silicium, and fluorine. In the absence of a quantitative method for estimating fluorine, boron, and silicium, we have an excessively delicate qualitative test. The best method of recognising the presence of fluorine consists in mixing the substance with potassic bisulphate, grinding the whole together in a small mortar, and introducing a small quantity of the paste slightly moistened into a glass tube, open at each end; place the substance at the lower part of the tube, and direct a blow-pipe flame on to it so as to heat the fluoride.

Under the combined influence of the water in the bisulphate of potash, and that resulting from the combustion of the gas, there are formed alkaline sulphates, with disengagement of hydrofluoric acid. It is true that if there is a sufficient quantity of silica, fluoride of silicium may be formed, but the result will be the same. This gas condenses with the globules of water a little beyond the part heated; if hydrofluoric acid has been formed the glass is attacked, and the same effect is produced if fluoride of silicium has been formed; in the latter case this gas changes in contact with the aqueous vapour into hydrofluosilicic acid and silica; if then the drop of water condensed with the acid is heated, the latter attacks the glass and becomes changed into fluoride of silicium. The glass tube should have been washed and dried carefully, and ought to be transparent; the same precautions must be taken after the operation.

In the case of boron the process is quite different. If no fluorine is present, mix the substance with a small quantity of fluoride of calcium and bisulphate of potash, having previously ascertained that the two reagents do not contain boron; two experiments must therefore be made, one on the reagents, and the other on the substance mixed with the reagents. The mixture is slightly moistened, and held on the extremity of a perfectly clean platinum wire. Direct the reducing flame of the blow-pipe on to the paste: at the moment when the mixture appears to boil the flame assumes a vivid green colour, characteristic of boron. When but little boron is present this must not be tried in full daylight, and it should be viewed against a dead black background; the colour of the flame will then be easily detected.

* O = 8.

VAPOUR DENSITY OF WATER.

The following remarks, by Mr. F. O. Ward, occur in a private letter recently addressed by that gentleman to a chemical friend. It will be perceived, by the familiarity of the style, and the cursory character of the statements, that this passage was not intended for publication. It contains, however, several indications of interest bearing upon theoretical questions which are at present strongly attracting the attention of chemical philosophers; and we believe that, in submitting it to our readers, we shall not unpardonably overstep the limits of editorial discretion.

"Can you tell me on whose authority rests the assertion that water expands 1,696-fold in becoming steam at 212° F? It is repeated from book to book, and I have repeated it myself in print (in one of the chapters of Hofmann's "Introduction to Chemistry.") It does not, however, by my reckoning, tally with the vapour-density of water, for

	Gramme.
2 litres of H at 0·0896 = ...	0·1792
1 litre of O at 16 × 0·0896 = ...	14·3360
	14·5152

The 3 litres being condensed into 2 we have ..... $\frac{14{\cdot}5152}{2} = 7{\cdot}2576$

as the vapour density of steam at ordinary pressure and temperature. A litre of water weighs 1,000 grammes, and $\frac{1000}{7{\cdot}2576} = 1377{\cdot}8$ for the expansion. Reducing the alleged 1,696 for temperature (by $\frac{1}{460}$ per degree F). from boiling point to 60° = 152° we have the ratio

$$\frac{208}{460} \times 1696 = 1266 \text{ as the expansion}$$

so deduced, against ..... 1377·8 as shown above.

Difference ..... 110·8 (over 8 per cent.)

This is a large discrepancy, and (unless I blunder in my reckoning) it shows error in one or other of the figures compared, which ought not, therefore, *both* to appear (as they do, the 1696 in so many figures, the other *implicitly*,)

in the same books (*vide passim* "Fownes' Chemistry," the only one I have with me in my trunk). One question this suggests to my mind is, whether we are not going a little too fast in accepting, as we are all disposed to do, the volumetric relations of bodies as so perfectly symmetrical? Just so, some years back, we were all seduced into the pretty belief that the ponderal relations of bodies were in Prout's simple multiple ratios. Stas stemmed and turned back that false current of chemical philosophy, and we may want a Stas to keep our volumetric opinions in the path of truth!

"The differences as to volume-ratios imputed *en masse* to 'errors of observation,' may, very possibly, have in some cases, an *actual existence*.

"It may well be, indeed, that as, in music, certain minute secondary vibrations give to musical tones their vowel modifications and all the admirable varieties of *timbre* which make up our orchestral wealth; so the small deviations from symmetry in the ponderal and volumetric relations of matter, may be the very conditions of the infinite variety we observe in the modulations of chemical phenomena in those unnumbered surprises of harmony and discord to which we owe the richness and beauty of our chemical orchestra." F. O. W.

ON A POSSIBLE CAUSE OF VARIATION IN THE WEIGHTS, ATOMIC AND OTHERWISE, OF ELEMENTS AND COMPOUNDS.

By JOHN A. R. NEWLANDS, F.C.S.

M. Stas has lately remarked that "hitherto nothing has proved that the differences found in certain analyses between experiment and calculation must be *wholly* owing to error in the operation; a certain part may be due to the inexactitude of the law of definite proportions.*" It is open for us then to inquire whether any cause exists which should induce the atomic weights of two or more elements to vary in different compounds, or which should make the atomic weight of a compound greater or less than the sum of the atomic weights of its constituents.

If the attraction of gravitation were the sole force concerned in the question, and if the force of gravity be assumed to be always the same for all bodies and at all temperatures, it would seem reasonable enough to believe that the atomic weight of each element would be expressible by an absolutely invariable number, and that the atomic weights of compounds would be absolutely the sum of the atomic weights of their constituents. I of course take it for granted, in this case, that the weighings should be performed in vacuo, and neglect the almost infinitesimal error which might possibly be caused by the amount of the ether of space, displaced by a given weight of matter, being greater in certain forms of combination than in others.

It must not be forgotten, however, that we are living on the surface of an immense magnet, and that all, or almost all, the constituents of the earth's surface are capable of being either attracted or apparently repelled by a magnet with a force which varies with the temperature, the state of combination, &c.; the magnetic attraction of the earth being most powerfully manifested at its two colder points, viz., the two poles.

Among the theoretical consequences of this state of things the following may be mentioned:—1st. A given weight of a magnetic substance would weigh more the lower the temperature, being under the influence of an increasing attraction. Thus, the oxygen of the atmosphere would, during the winter, be drawn to the earth with more force than during the summer; and also, as a general rule, be attracted more in the night than in the day.

2nd. A given quantity of an element would weigh more when in the state in which it was attracted by the magnet than it would in another state. Thus, a given quantity of iron would weigh more in the state of black oxide than in the state of potassium ferrocyanide. The weight of a compound might, therefore, be less than the sum of the weights of its constituents; thus, the weight of ferric oxide, which is but slightly magnetic, would be less than the sum total of the weights of the iron and oxygen it contains, weighed separately, both of these being highly magnetic. By the reverse of this operation, it is possible that the weight of some compounds of certain elements, apparently repelled by the magnet, such as bismuth and thallium, might be greater than the sum of the weights of their constituents.

3rd. The magnetic attraction of the oxygen of the air above any substance might possibly reduce or augment its weight, according as it might be of a magnetic or diamagnetic character.

4th. A portion of the increase of weight which takes place when a given quantity of matter is transferred from the neighbourhood of the earth's equator to that of its poles, may be due to the increased magnetic attraction of the latter, If such be not the case, we should find the gain in weight of iron, under these circumstances, to be no greater than the gain in weight of bismuth.

5th. Admitting the existence of a variety of small bodies, or fragments of planets, meteorites, &c., of all kinds of composition, travelling through space, and approaching from time to time the earth's path in their respective orbits, we should expect to find if they were drawn to the earth by the action of gravity alone, pure and simple, that the substances so falling would be of all shades of composition. On the contrary, if they were drawn to the earth by virtue of its magnetic powers, we should find that the substances so falling would consist entirely, or at least partially, of bodies of a highly magnetic character, such as iron and nickel, and never of diamagnetic substances, such as bismuth and antimony. This latter view is corroborated, to a great extent, by the analysis of meteorites. Those who maintain that the fall of meteorites is due to gravity alone, must also believe that the proportions of iron and nickel to other kinds of matter in surrounding space is far greater than we know it to be on the earth's crust, and that the earth attracts only iron and nickel because it has nothing else to attract. The presence of hydrogen gas in some specimens of meteoric iron may be explained by supposing that the iron in question originally contained within its substance a minute amount of water, and that as it became heated by passing into the earth's atmosphere, this water was decomposed. The oxygen, under these circumstances, would unite with the iron to form black oxide of iron, and the hydrogen thus set free would be retained within the pores of the softened iron in a highly compressed state, as was the case with that found by Graham in the meteoric iron of Lenarto.

If the amount of hydrogen so liberated were very great, the heated mass would explode and split up into a number of smaller meteorites. This explosion of meteorites has also been observed.

6th. As far as the magnetic attraction of the earth is concerned, the fall of meteorites would occur mostly in the vicinity of the north and south poles. A large quantity of finely divided meteoric dust descending in this manner into the earth's atmosphere, and becoming ignited therein, might contribute to the phenomena of aurora borealis and australis.

7th. If the magnetic intensity of the earth be liable to secular variation, we should find the ordinary weights, and also the atomic weights, of substances to vary likewise.

8th. If the real atomic weights of the elements, after eliminating the magnetic action of the earth, could be obtained, we should probably be able to observe numerical relations between them of a simpler character than can at present be found. They might then prove to be multiples of a unit, without any fractions whatever, in

* Chemical News, June 14th, 1867.

accordance with the idea of Prout, as modified by M. Dumas.

9th. The length of a pendulum vibrating seconds would be different if constructed of a magnetic or of a diamagnetic substance.

ON THE ACTION OF NITROGEN ON THE SILICIDES OF MAGNESIUM AND CALCIUM, AND ON A NEW DEGREE OF OXIDATION OF SILICIUM.

By M. A. GAUTHER.

Silicium possesses but a small affinity for nitrogen, which affinity only becomes manifest near its fusing point. The author considered that the combination might be more easily effected by making nitrogen act on silicide of calcium, and especially on silicide of magnesium, magnesium having itself a strong affinity for nitrogen.

Wöhler's silicide of calcium, heated to a red white heat in a current of nitrogen, increased 5·2 per cent in weight; but the surface only of the silicide was attacked, a small quantity of nitride of calcium was formed, and the silicium separated. The crystallised silicides of magnesium, when treated in the same way, gives a black mass, which behaves like a mixture of silicide and nitride of magnesium; by the action of water it gives ammonia and magnesia, which dissolves on addition of hydrochloric acid, leaving the silicium pure; thus again, the nitrogen was only fused on the metal.

The author prepared silicide of magnesium by the action of magnesium on fluosilicate of sodium. Place at the bottom of a Hessian crucible a layer of chloride of sodium, melted and pulverised; then a mixture of 7 grammes of fluosilicate of sodium with 2½ grammes of chloride of sodium, and over this mixture 2½ grammes of magnesium in lumps. Cover the whole with melted chloride of sodium, heat the crucible quickly in a good wind furnace; when the reaction, which is lively, abates, leave the crucible in the fire five minutes, then take it away and stir the mass with a clay spatula, cover the crucible, and let it cool. Whilst the crucible is open, part of the magnesium burns in the air, giving magnesia and nitride of magnesium; the metallic button contained in the crucible is more or less rich in silicide of magnesium; when it contains an excess of magnesium, which occurs when the temperature is raised too slowly, this button may be considered as magnesium, and submitted to a new operation. First treat it with water to remove the dross, and then with a cold dilute solution of sal ammoniac, which dissolves the magnesium. Metallic crystals are easily obtained, and the silica may be mechanically separated by rubbing: they generally represent 10 per cent of the weight of the magnesium used: they are leaden grey, and seem to be regular octaheda. A hot solution of sal ammoniac attacks them, disengaging hydrogen, accompanied by silicated hydrogen, leaving a residue of silica. Hydrochloric acid completely attacks them in the cold, giving hydrogen, silicated hydrogen, and a white residue having the form of crystals, and constituting an oxide of silicium which will be noticed later. The composition of silicide of magnesium is explained by the formula,

$$Mg_5Si_2 \text{ (Si, 41·2; Mg, 58·8 per cent).}$$

The author takes Si = 21; Mg = 12. In taking Si = 28 and Mg = 24 this formula becomes Mg_5Si_3.

The author considers that the silicide to which M. Wöhler assigned the formula,

$$Mg_2Si \text{ (Si, 30·6; Mg, 52·9 per cent),}$$

was impure and contained silica.

The dross formed in the preparation of this silicide contains another product, crystallised in cubes, insoluble in water, and which is a double fluoride of sodium and magnesium:

$$NaFl,2MgFl,$$

which may also be obtained by melting chloride of magnesium with fluoride of sodium in excess, and chloride of sodium. The crystals of silicium which accompany them may be removed by treating them with a mixture of hydrofluoric and nitric acids.

Oxide of Silicium.—This oxide, which is formed by the action of hydrochloric acid on silicide of magnesium, has already been indicated by Wöhler, who had obtained it by the action of hydrochloric acid on the silicide, but he did not give its composition. Prepared with pure silicide, it is perfectly white, and possesses all the qualities indicated by Wöhler. Treated with potash, it disengages hydrogen; heated in a tube, it leaves amorphous silicium, and gives a gas which smokes in the air. It is not attacked by concentrated and boiling sulphuric acid: nitric acid attacks it slowly. Its composition is—

$$3SiO_2,2HO, \text{ or } 4SiO_2,3HO.$$

By operating with the greatest precaution, and by taking care that the temperature does not pass 0° when attacking the silicide of magnesium by hydrochloric acid, hydrated oxide may be obtained, having this composition:

$$2SiO_2,HO.$$

In taking Si = 28, O = 16, these formulæ become $3Si_3O_4,4H_2O$; $2Si_3O_4$ and Si_3O_4,H_2O.

According to the author these bodies are very different from the *leucon* of M. Wöhler. Leucon is richer in hydrogen and silicium than the preceding compound; according to MM. Geuther and Sheerer it is a hydrate;

$$SiO,HO.$$

Thus it is $Si_3O_2,2H_2O$.

After a discussion, which it would be difficult to resume here, the author concluded that there were four oxides of silicium:

$$Si_2O,\ SiO,\ SiO_2,\ SiO_3;$$

Or with Si = 28, and O = 16: Si_3O; Si_3O_2 : Si_3O_4; SiO_2; and for the silicated hydrogen, SiH_2; the silicide, Mg_5Si_2, becomes $Mg_5Si_3 = 2Mg_2Si + MgSi$. He admits that the silicated hydrogen is H_3Si_2, and that the silicide of magnesium, Mg_5Si_2, ought to be regarded as a combination of two silicides,

$$3Mg_5Si_2 = 4Mg_3Si + Mg_3Si_2,$$

only the silicide, Mg_3Si_2, taking part in the reaction which produces the silicated hydrogen, whilst the silicide, Mg_3Si, gives rise to the hydrate, $2SiO_2,HO$.

ON THE LOSS OF SULPHURIC ACID IN SALT-CAKE MANUFACTURE.

By CHARLES R. A. WRIGHT, B.Sc.

More or less sulphuric acid is always lost in the process of conversion of sodium chloride into sulphate, through the mechanical effect of the escaping gases in carrying off vesicles of acid and sulphate spirted up; in the roasters also a portion of sulphuric acid is volatilized as such, especially if so much acid have been added as would be necessary to convert the whole of the sodium chloride into sulphate. The total amount thus lost necessarily varies in different instances, being dependent on the form of pot and roaster used, the mode of applying heat, &c.; and especially on the amount of salt left undecomposed in the salt-cake. When ordinary salt-cake is withdrawn from the roaster, a white cloud or vapour is emitted from it; when the amount of acid originally added is sufficient to decompose all the sodium chloride present, and when the roasting has been carried so far as to decompose from 98 to 99 per cent of the chloride, the escaping vapour contains mostly sulphuric acid with but little hydrochloric; if more sulphuric acid have been originally added, and the roasting carried so far as to leave only 1 to 1·5 per cent of "free acid," a good deal of sulphuric acid is given off from the salt cake on withdrawal from the roaster; whilst, if less than the requisite amount of sulphuric acid have been originally added, so that 4 to 6 per cent of the sodium chloride remain undecomposed, the vapours emitted consist chiefly of hydrochloric acid.

Some experiments made on this subject by the writer, together with some similar details kindly furnished by different manufacturers, yielded the following results:—

Nature of Furnace, &c., used.	Average per-centage of undecomposed salt in the salt cake.	Approximate amount of sulphuric acid lost out of 100 parts originally used.
1) Open Furnace	0·60	12·6
2) Blind furnace: one pot.		About 6
3) Ditto ditto	3·40	Less than 1
4)* Ditto ditto	5·00	1·0
5) Ditto two pots	3·00	2·4

As might be anticipated, there seems to be a greater amount lost with an open furnace than with a blind one; apparently also when salt-cake containing 95 per cent of available sodium sulphate (*i.e.*, 5 per cent of sodium chloride, "free acid," ferric oxide, moisture, &c.) is manufactured in blind furnaces, the average amount of sulphuric acid lost is about 2 parts in 100. Such salt-cake will contain about 54·5 per cent of SO_3, and consequently 100 parts of salt-cake will require for its production about $54·5 + 0·02 \times 54·5$ or 55·6 parts of SO_3. Acid of specific gravity 1·591 at 15°C. contains 55·6 per cent. of SO_3 (Bineau); hence a kilogramme of such salt cake represents a kilogramme of sulphuric acid of sp. gr. 1·591; or 0.68 kilogram of SO_4H_2.

It may be noticed that in (4), the SO_3 present in the shape of sodium sulphate in the condensed muriatic acid was only about one-sixth of the total amount: hence indicating that the majority was derived from the roaster where the heat would be sufficient to volatilize SO_4H_2 as such; the mechanical transfer of vesicles spirted up, is however evidenced by the presence of perceptible amounts of sodium compounds in the gases passing off from the pot.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

Artificial Milk; Manufacture of it in England; Analysis Disputed.—Report of the Weights, Measures, and Coins Committee; Official Recommendations.—New Process of Evaporation.—Improvements in Electrotyping Copper.

PARIS, July 10, 1867.

AT the last meeting of the Academy of Medicine two protestations were again made against the artificial milk of Baron Liebig. The first is by M. Boudet. The second objection was raised by M. Poggiale, in the following terms:—Baron Liebig tells us that his artificial milk is manufactured on a large scale in England; that there is an industrial Company which carries on the business on a large scale. The important point to be considered is, whether this new product differs widely in composition from human milk. Baron Liebig has taken as the basis of his preparation that of a milk analysed by a German chemist, named Haideln. This analysis is very old, and when it was made scientific men were not provided with the means which are now at their disposal; and the results have, therefore, been contested.

Nevertheless, in accepting, and taking for granted the truth of Haideln's analysis, we observe that in the formula of M. Liebig the plastic elements are represented by 10, and the respiratory elements by 38, instead of 24 required by the analysis of M. Haideln. The composition of the artificial milk thus differs much from the true proportions, and in this respect it is inferior in quality to natural milk. In it the fatty matters are replaced by starch. But glycose, it is well known, gives less heat, and therefore cannot replace advantageously the sustances we have mentioned. We may also ask why does Baron Liebig add bicarbonate of potash? this new element gives to the milk a taste far from agreeable. In a word, this artificial milk differs from the natural, by its odour, taste, colour, and chemical composition. We should certainly recommend, in preference to it, milk which is most similar in composition to human milk, namely, cows', goats', and asses' milk.

The Committee of Weights, Measures, and Coins, at the Universal Exhibition of Paris, 1867, have made their official report relative to units of measure and weight. The commission advance the following measures:—The prompt substitution, in all its integrity, of the metric system, for the old systems of weights and measures, as it is practically adopted in several other countries in the west of Europe. This system, introduced and legalised optionally, cannot be at once rendered imperative to the exclusion of every other system. A certain delay is necessary for the change; and the different nations are alone capable of fixing its duration, Let us observe in the meantime that experience in several countries has proved that a too long delay does not have the effect of sensibly facilitating the accomplishment of this task. Thus it is desirable that Governments take, henceforth, the following measures, viz.:—

1. To order the teaching of the metric system in public schools, and to require that it should form part of the public examinations.

2. To introduce its use into scientific publications, in public statistics, in postal arrangements, in the custom houses, and other branches of Government administration.

3. The commission does not consider, as appertaining to its mission, the duty of making standards the exact prototypes of those of Paris. The Government of each country will take upon itself the verification of each of these standards.

The commission declares that the present report contains the expression of its deliberations and conclusions. It expresses a wish that different nations will yield to the solicitations of science and the manifestations of opinion.

A new evaporating process is carried on by M. E. Parion, at Wardrecques, St. Omer. This process is carried on essentially by the renewal of the surface of the liquid exposed, in the state of fine division, in contact with the air, or the products of the combustion according as the evaporation should take place, with or without the aid of artificial heat. When the evaporation takes place by the aid of the temperature of the air alone, the liquids are divided into a small shower exposed to the wind and sun. By maintaining them in this state, we obtain in a small space, and one easy to cover when necessary, the same results as the concentrating basins and the graduating buildings give, at great cost, and with a vast extent of land.

In the case of the employment of artificial heat, the waste heat from chimneys of factories is utilised in preference, and in the absence of this any source of heat is employed if the products obtained have a sufficient value to pay the expenses.

The reduced model of the apparatus for evaporating by the aid of artificial heat, is exhibited at the Universal Exhibition, class 50, group VI.; moreover, a small apparatus is at work in the annexe at Billancourt.

M, Bouillet has discovered a remedy for a defect in the electro deposition of copper, which is sometimes seriously injurious, viz., its brittleness. He has found that a very small quantity of gelatin dissolved in the bath gives a copper of nearly equal malleability to rolled copper, whereas the pure bath only gives a porous defective metal like cast copper. The relative specific gravities of copper in different states are: cast copper, 8·78; laminated copper, 8·95; galvanic copper, 8·86. Gutta-percha moulds are exclusively used by the firm of Christophle and Co. They are applied, either cold by pressure with a lever, or by the hand. The mould is rendered conductive either by black-lead or silver, reduced from the nitrate by nascent hydrogen.

F. MOIGNO.

*Deduced from the average composition of salt-cake and condensed muriatic acid.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Messrs. C. Allhusen and Sons, of the Tyne Chemical Works, Gateshead, and of Newcastle-upon-Tyne, obtained a medal in Class II. Section A. for their display in the English Exhibition of 1862, and that they fully sustain their old position is evident from their present exhibition illustrating the manufacture of soda. They show bicarbonate, sulphate, and crystals of soda, alkali, caustic soda, of 60 and 70 per cent, chloride of lime, &c. As we stated in our last, they have obtained a gold medal for the superior quality of their productions.

It is both interesting and instructive to study the mechanical and chemical requirements of one of these colossal chemical manufactories. We all know the enormous space required for vitriol chambers, and the absorption apparatus for making chloride of lime. In addition to this, which alone forms an immense plant, there are actually saw-mills, common and fire-brick manufactories, coke-ovens, and gas-works, besides, of course, an extensive cooperage. Such is the nature of Messrs. Allhusen and Sons' "plant," and they are, we believe, by no means the largest manufacturers of their class. After this we shall not be surprised to hear that their weekly consumption of raw material is as follows:—

Coal	2,250 tons.
Pyrites	350 ,,
Nitrate of soda	10 ,,
Chalk	900 ,,
Salt	450 ,,
Manganese	100 ,,
Limestone	125 ,,

The weekly production of sulphate of soda is 500 tons, equivalent to 375 tons of soda ash or unrefined alkali; which is in subsequent processes converted into quantities varying with the demand, and not exceeding separately 450 tons of crystals of soda, 150 tons refined alkali, 100 tons bicarbonate soda, 30 tons caustic soda, and 110 tons chloride of lime.

So much has been written and said about the soda process, that it is entirely unnecessary to enter upon the subject here, except to say that in spite of the innumerable attempts that have been made to supersede Leblanc's method, it is still adhered to by all manufacturers of soda. It is true that Mr. W. Gossage, of Warrington, (whose name has been so long and intimately connected with the alkali manufacture) has devised a new plan which appears to have the germs of success in it; but whether it is absolutely a commercial success, we are not at the present moment aware. This much is certain, that the new process cannot be in the hands of anyone more aware of the difficulties lying in the way, or better prepared successfully to encounter them.

Vauquelin a very long time ago endeavoured to take advantage of a reaction which even appears to have been known to the alchemists, namely, that when chloride of sodium is heated to a high temperature in presence of silica and water vapour, hydrochloric acid is evolved and a silicate of sodium formed. The production of soda from this silicate is a problem that has attracted a vast number of chemists, but, up to the present time, unsuccessfully. Tilghmann in 1847, and Fritzsche in 1858, have both attacked the question, but, as far as we know, with no material advantage.

Mr. Gossage subjects the silica to the action of chloride of sodium *in the state of vapour*, and in an atmosphere of steam. This is effected by sending the steam and the vapour of the salt into a large tower lined with fire brick and filled with flints. The silicate of soda flows down, thus exposing a fresh surface of the flint to the action of the vapour. The silicate of soda has to be decomposed by either carbonic acid or lime. The details of this part of the process are not in our possession at present, and from the known difficulties which lie in the way, must be very ingenious and instructive; we hope, however, to be able to lay a complete account before our readers at no distant period.

Mr. Gossage has most deservedly had his labours recognised, he being one of the few English exhibitors of chemical products who have been awarded a gold medal.

Before proceeding any further in our notices of the English exhibitors, we must once more express our deep regret that none of the manufacturers of aniline dyes were represented. When we remember the part that England has taken in the discovery and investigation of coal tar colours, it is almost humiliating to see the brilliant cases of foreign manufacturers, whose only part in the matter has been to infringe our patents, and by deluging the market with cheap, and in most cases inferior colours, bring the trade to the verge of ruin. This remark, be it understood, is not intended to apply to the French chemists, who, it must be admitted, have treated us with far more justice than our German brethren. We looked in vain for a specimen of the superb Britannia violet of the MM. Perkin, which for two years has been the most successful rival of Hofmann's violets. For a long time its extreme solubility in water (almost as great as ordinary "Hofmann" in spirit) made it stand alone, but we believe that M. Porrier's violet from methyl-aniline is also remarkable in that respect as well as for its brilliancy. A method has also been adopted, we understand, for rendering Hofmann's violet soluble in water.

The cases of MM. Perrier and Cheppet Fils, and of the Fuchsine Company, are, especially the latter, exceedingly interesting and well arranged, and the more we admired them the more vexed we were to see no rivals to them in the English department, especially when we knew how easy it would have been for Perkin and Nicholson and Co. to have beaten them.

The question has often been asked us, "Did the Fuchsine Company ever bring out any colour of their own invention?" Perhaps some of your readers will be able to answer this.

The next case in order which we shall notice, is that of Messrs. Samuel Berger and Co., who display specimens of rice starch; but their case, which looks very dull, has only two dishes of starch and seven show cards in it, and therefore simply seems as a foil to the case of J. and J. Coleman, and Isaac Beckitt and Sons. Both those firms gained medals in the English Exhibition of 1862. The starches of all these makers appear of the finest possible quality. Messrs. Coleman and Co., and Messrs. Beckitt and Sons both show coloured starches of various shades. By means of these tinted starches muslins can be "got up" of any desired tint, and ladies can therefore have a muslin dress of a different colour every day, it being merely necessary to wash it and then stiffen with starch of the desired hue. We have been informed by those who have used them, that the results are all that can be desired.

Perhaps some of your readers may be unaware that starch can be dyed with the utmost facility, and without destroying the granules, by merely filtering a solution containing the desired colouring matter through a layer of the starch. When dried at a very moderate temperature, the so-called "starch lakes" are thus produced, and in brilliancy and soft beauty of tone they are perhaps unsurpassed. Unfortunately colours thus prepared have but little "body," and, what is perhaps worse, they are decidedly fugitive. Nevertheless for many purposes where a beautiful "mat" surface is required of velvety texture, they are very useful. Coloured confectionery may be cited as an instance where the starch lakes may be legitimately employed.

Messrs. Isaac Beckitt and Sons have had the wisdom to display, side by side with the coloured starches, muslins of corresponding tint prepared by their use. We would recommend these gentlemen to renew the muslins, and also the coloured starches, at moderate intervals, as they will not stand many months of glaring daylight, without undergoing deterioration.

We are not with certainty aware of the nature of the dyes used by these firms for the purpose of colouring their starches, but all the coal tar colours are admirably adapted for the purpose, as the colour is almost entirely absorbed when cold aqueous solutions are filtered through a moderately thick layer of the starch.

REPORTS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

A COURSE OF FOUR LECTURES ON

SPECTRUM ANALYSIS,

WITH ITS APPLICATIONS TO ASTRONOMY.

By WILLIAM ALLEN MILLER, M.D., F.R.S., &c.

LECTURE III.

Solar spectrum.—Methods of observation.—Constituents of the solar atmosphere.—Spectra of the moon, and of the planets, comets, and meteors.—Inferences.

(*Continued from page* 11.)

I have now to explain to you how Kirchhoff has made these lines interpreters of the composition of the sun. When a series of electric sparks is made to pass between wires composed of any metal, the spark, when examined by the prism, exhibits the special spectrum of the metal. For instance, in this case we have two wires consisting of silver. If I cause this secondary current from an induction coil to pass in sparks through the interval of air between the two silver wires, particles of the metal will be detached in a gaseous condition, and they will give the special spectrum of silver. The heat produced in this way is most intense. Any other metal may be substituted for the silver, and may thus be made to yield its spectrum, the metallic points being placed in such a position that the light of the spark shall be reflected into the spectroscope, and so into the eye of the observer.

I have already stated that it had been ascertained by Fraünhofer and other observers that a particular double black line, called D, in the sun's light, coincided with a bright line which was observed in certain flames, now known to be due to sodium. Kirchhoff, in order to ascertain the exact coincidence of the line D with the sodium lines, placed the light of the sodium so that the sun's light passed through it, and he found that, instead of getting the bright sodium line, he got a still more intensely dark line; he, in fact, discovered that the sodium line was reversed by the action of the more brilliant light of the sun, as already explained. But having found this in the case of sodium, he immediately began to examine other bodies in the same way, and he found that the lines of barium, strontium, and other metals were similarly reversed. He then began systematically to compare the bright spectra of the metals with the dark lines of the solar spectrum. When, for instance, iron is acted upon by the electric spark in the way I have described, it gives rise to a spectrum which contains some 70 bright lines in the space between the extreme red and the extreme violet. These bright lines differ very much in degrees of brightness: some are strong; some are weak; but the interesting point observed by Kirchhoff was not merely that for every bright line in the spectrum of iron there was a corresponding black line in the solar spectrum, but that they also corresponded in intensity. The brightest lines of the iron spectrum were the blackest in the sun's spectrum, and the feeblest in the iron spectrum were precisely the feeblest in that of the sun. This was a case not of the coincidence of two lines merely, which some persons might suppose to be an accident, but it was the coincidence of some 70 lines, line for line, and strength for strength. It is impossible to have a more striking proof of the identity of the cause by which these two effects were produced. Well, having ascertained in the case of iron that this coincidence occurred, he proceeded to take other metals, and among them magnesium. This metal gives a very limited spectrum, consisting of a remarkable triple group in the green, and that group is found to coincide absolutely in strength and in position with the dark line marked *b* in the spectrum; for when this solar line is examined with care it is found to consist of three black lines, exactly corresponding in character with the three lines of magnesium. Magnesium in vapour, therefore, is one of the constituents of the atmosphere of the sun. So I might go on particularising the character of each metallic spectrum, but to save time I have enumerated in this list all the metals which are known to exist in the sun's atmosphere:—

Sodium.	Nickel.
Calcium.	Zinc.
Barium.	Strontium.
Magnesium.	Cadmium
Iron.	Cobalt.
Chromium.	Hydrogen.

Copper might have been added, though its presence is rather doubtful. Others are also marked as doubtful. Though many of their lines correspond with dark solar lines, yet there are other lines produced by these metals which have no corresponding lines in the solar spectrum. That may arise from the circumstance that the proportion in which they occur in the sun's atmosphere is small. As a rule, the metals which are enumerated in the list furnish bright lines corresponding, line for line, with dark lines in the spectrum of the sun.

Now, this leads me to another important point. It will naturally be suggested to the mind, "It is very true that these are lines produced in the light which leaves the sun, before it gets to us; but how do we know that they are produced in the sun itself? All the substances of which we have seen lines in the solar spectrum are bodies which we know upon the earth. Is it not possible that all these bodies may exist in such quantities in the earth's atmosphere that they may be the means of shutting out these rays of light which are found to be deficient in the sun's rays when they reach us?" That is, certainly, an important question; but it can be answered perfectly. If we had only the light of the sun to judge from, it might be a difficult point to decide; but we have in the stars a multitude of other bodies from which we derive light quite independent of that of the sun. If we found that every star gave us the same spectrum as the sun, then we might well question whether these lines were really due to matters existing in the sun, or whether they were not due to bodies in the earth's atmosphere. But, as we shall see in the next lecture, every star gives a spectrum of *its own*. Now the light which comes from the stars ought to be acted upon exactly in the same way as the light of the sun, if the cause of the lines were in the atmosphere of the earth. We find it is not so. The cause, therefore, does not reside in the atmosphere of the earth,—at least in the majority of cases; although, as I shall show you presently, there are certain lines truly due to the action of the earth's atmosphere.

Spectrum analysis cannot tell us whether the visible surface of the sun is solid or liquid, or whether it is made up of cloud; because either a cloud, or a liquid, or a solid body would give us a continuous spectrum. If we took the light emitted by phosphoric acid, produced in burning phosphorus in oxygen, it would give us a continuous spectrum just as the surface of the sun does. But we know that there is a great atmosphere outside the visible disc of the sun which is revealed to us temporarily during a total eclipse. That great atmosphere contains bodies of all sorts in a state of vapour, volatilised by the enormous heat which is produced in the sun itself. Of course the farther this extends from the sun the colder it must be, and therefore there must be a point in the sun's atmosphere in which we are precisely in the position required to give this reversal of the bright lines due to each metallic vapour; that is to say, we must have an

intensely heated nucleus behind a colder atmosphere; but even this colder atmosphere may be so intensely heated as to keep all these bodies which we cannot even volatilise in our furnaces, in a state of vapour: if so they must give us the dark lines observed in the solar spectrum, by absorbing, from the light of the incandescent nucleus of the sun, vibrations of the particular frequency corresponding with those produced by the metallic vapours themselves. Thus, in the light which comes to us, we have proof from the absent vibrations. We have, I say, a proof of the existence of these atmospheric bodies in the sun which arrest the corresponding vibrations produced behind them. That is the proof which Kirchhoff has given us of the presence of these bodies in the sun.

I stated just now that there are lines produced by the earth's atmosphere. This is a curious observation. It was first made by Sir David Brewster, and he arrived at the fact in this way. Here is a diagram, which may help to make it plain. Suppose this part to represent the globe of the earth, and here is an exaggerated representation of the atmosphere. You can see easily that if the sun were nearly vertical, the light would traverse a much smaller portion of the atmosphere than it would when its beams are nearly horizontal, near sunrise or sunset. The sun's light would then have to traverse a portion of the atmosphere nearer the earth, and greater in density than that through which the light would pass when the sun was high up; so that if the spectra are different when the sun is in these two different positions, we might then say that it is probable that this effect is due to something in the atmosphere of the earth itself. Sometimes opportunities of proving this occur accidentally. I have had myself such an opportunity. I was one day looking at the spectrum when a thunder-shower came on; suddenly there started into view a group of new lines, evidently produced by some sudden change in the air at the moment. The storm shortly after subsided, and the changes which had occurred in the spectrum vanished. M. Janssen, a distinguished French experimentalist, and Prof. Cooke, an American man of science, have both made observations which show that variations in the amount of moisture in the air are connected with changes of this kind. The experiments which M. Janssen made were of this kind. On the border of the lake of Geneva, he caused a pile of wood to be lighted on the top of a mountain. Having stationed himself on the other side of the lake, about thirteen miles off, he viewed this fire through a spectroscope, across the body of moist air resting upon the lake, taking care to have it at the same time observed near at hand, where a continuous spectrum only was seen. In this way he detected the presence of certain lines in the less refrangible end, occasioned by moisture contained in the atmosphere. He afterwards performed another ingenious experiment, which I regret that I cannot show in this theatre. He took an iron tube, of about 37 mètres, that is, about 40 yards, in length, closed by plates of glass at the extremities. At one end he placed a gas flame, and then looked through the tube at the spectrum of the flame, by means of a spectroscope, and thus obtained a continuous spectrum. He then injected into the tube some steam, at a pressure of 7 or 8 atmospheres, so that he got a dense body of aqueous vapour. Then, on looking through the tube at the flame by means of the spectroscope, he saw in the red part of the spectrum, lines, something like those which are seen in the diagram,—strong bands of lines, evidently produced by the absorptive action of the aqueous vapour in the tube. The temperature and the pressure of the vapour were high, but they had nothing to do with the production of the lines; they were merely used as a means of getting a large mass of vapour into a small space.

In the application of this observation we have a number of curious and very interesting facts. You will remember that the solar light has this remarkable feature,—and, indeed, all lights are the same in that respect,—that whether it is seen directly, or whether it is reflected from a clean white surface, it still betrays its origin; that is to say, it always shows the same lines. If we were to look at the spectrum obtained from the sun's light direct, and then look at the spectrum of the same light after reflection from the surface of a cloud or from a mirror, we should find that the position and number of the lines were just the same in both instances. In the reflected light we should not have so intense a spectrum, but the lines would be in just the same places as in the direct light, and we should know for certain that the light in either case came from the surface of the sun.

Now, what is true in this case appears to be true in all cases of reflection. It is true, for instance, in the case of reflection from the moon. I will throw upon the screen a representation of the moon, as it appears from one of Mr. De la Rue's recent photographs of the moon. What I want to call your attention to is this, that we have in the spectroscope the means of travelling over the surface of the moon, and examining the quality of light reflected from its different parts. Now, what use can we make of this? Suppose we wish to examine whether the moon has an atmosphere. We find, by the telescope, that we can see right down to the surface of the moon. The parts of its face are never obscured by clouds or by dark vapours connected with the moon itself. But it might yet happen that a delicate atmosphere, containing a very small quantity of vapour, existed round the moon, and the thickness of this stratum would necessarily vary when viewed at different parts of the surface. If we looked at the edge of the moon, the effect would be similar to that produced by viewing the sun near the horizon, the light which was transmitted from the edge would come through a long column of this atmosphere before it reached us. If we looked direct at the centre of the disc, where the light would have to traverse a smaller depth of atmosphere than at any other point, we ought, if there were any atmosphere containing absorbent vapours, to observe a difference between that light and the light at the moon's edge. Now, on looking at these different portions of the moon, we find that the light comes from all parts, without any change. Hence we must conclude that if there is an atmosphere around the moon, it must be so excessively dilute that it cannot produce any absorptive change in the light which is perceptible in its spectrum.

Again: we can apply these observations to show that the moon does not shine of its own light, though we do not need the proof of that fact from this source; and we may also apply the same proof to all the planetary bodies. But though we already know that the moon and the planets shine by reflected light, in other instances the knowledge we can thus derive may be of importance to us. Take, for example, the case of a comet; does that shine by direct or reflected light? I will show you how this question may be answered. But, before doing so, it will be desirable to consider the result obtained by observations upon Jupiter,—a body which certainly shines by reflected light. And here we acquire some information regarding the atmosphere which surrounds Jupiter, because the light reflected from Jupiter is not identical with the light which falls upon it. Here is a diagram of some observations made at Tulse Hill, by Mr. Huggins and myself, which may make this clear. The spectrum of Jupiter's light shows us, in particular, a dark band in the orange. Besides the ordinary solar lines, which are very well seen in the case of Jupiter's light, there are groups of lines connected with the atmosphere of the planet. The object was to see whether the spectrum produced by Jupiter was different from that of the earth's atmosphere; and this object was attained by comparing the light of the planet with that of the sky, which was at that time reflecting the light of the setting sun, under circumstances in which a reflected spectrum from the surface of the sky itself was not too intense for comparison with the spectrum of Jupiter. These are some photographs of drawings of the appearance of Jupiter, made some years ago by Mr. Huggins, from telescopic

observations. Astronomers have long believed that an atmosphere of considerable density exists around this planet. These bands or belts are produced, it is supposed, in consequence of clouds accumulating near its equator. They show us that, in all probability, the atmosphere of Jupiter is largely charged with aqueous vapour, and that the surface of the planet itself is not actually seen. Consequently, the light which we see reflected by the planet does not come from the body of Jupiter itself; it penetrates to a certain depth, and then comes back, after traversing a portion of its atmosphere; and therefore we do not know what is the actual condition of its surface. In Saturn and Mars we also obtain, by means of the spectrum, a certain amount of knowledge of the state of things upon both those planets. In the spectrum of Mars a number of bands in the blue make their appearance. It has been supposed that the red colour of Mars was produced by a peculiar colour of the soil. These spectrum observations seem to show that it is due rather to something in the atmosphere, and not to anything in the soil; because, if it were the latter, we should merely have a blotting out of the spectrum, and there would not be a series of regular bands, which have been observed in the case of Mars.

I have stated that by the method of spectrum observation we may ascertain whether comets are self-luminous, and may even attain to some knowledge of their composition. Our knowledge of the spectra of comets is, indeed, excessively limited. Donati, in 1864, made some observations; but the results he obtained were not very definite. I believe that those of Mr. Huggins, upon the small telescopic comet of 1866, are the best at present existing. It had a bright central nucleus, and around that was a nebulous atmosphere, not prolonged into a tail, as is usual in most comets. By means which I must explain in the next lecture, the spectroscope was brought to bear upon it, when it was found that the coma, or tail, gave a prolonged continuous spectrum, and in the middle of that spectrum there was a spot of bright greenish blue colour, indicating the position of the nucleus. What information does this give? It appears to show that the spectrum of the coma is produced by reflected light, and that the tail of the comet is somewhat in the position of a fog; that that fog reflects from the sun light of all colours, whilst the central portion is giving out light of its own, and light of one colour only. However, I have not time to-day to go into that point. I shall take it up again in connection with those remarkable bodies, the nebulæ, with which I shall deal in the next lecture.

ACADEMY OF SCIENCES.

July 1, 1867.

(From our own Correspondent.)

New Volcanic Islands.—Works of Lagrange.—Sir D. Brewster on Lighthouses—Aniline Colours on Cotton.

M. Chevreul, president, opened the meeting, and in the absence of the perpetual secretary read the correspondence, minutes, &c.

M. C. St. Claire Deville handed in a note inserted in a Portuguese journal, the *Perseveranjia*, announcing that between Tersira and Graciosa, two islands near Lisbon, have been subjected to continual volcanic eruptions; very strong shocks of earthquakes have been felt, and have produced many islets, one after the other, analogous to those of Santorin in Greece. On the 1st June a submarine volcano cast up igneous matters in such quantity, that a tongue of land has been formed with the continent. This ground is as yet unapproachable, on account of the incandescence of the rocks, as well as the sulphurous vapours from the fissures. M. Deville asked that the Academy should take an interest in these new eruptions, as it did in those of Santorin.

M. Treuil read a note on the lactiferous vessels of fig-trees and euphorbiacea.

M. Serret presented to the Academy the first volume of the works of Lagrange, which were published under his direction by order of the Minister of Public Works. This great work consists of eight volumes of 1,800 pages each, with plates, and will be distributed to each member of the academy. They contain papers on mathematics, chemistry, physics, anatomy, hydraulics, &c.

Sir David Brewster sent a very interesting memoir on the history of light-houses and dioptric apparatus.

M. Morris sent a copy of his book on wine making, &c.

M. Fournet, of Lyons, sent a great memoir on atmospheric electricity.

M. Chevreul read a note from M. Biddeman, at Berlin, on aniline colours for cotton.

The meeting then resolved itself into a secret committee to elect a member in place of M. Pelouze, deceased, MM. Cahours, Berthelot, and Wurtz are proposed; M. Wurtz will most likely succeed to the vacant chair.

July 9, 1867.

Practical Meteorology—Letters from Rotrou to Cardinal Richelieu—Alleged Discovery of the Law of Gravitation by Pascal, prior to Newton—E. Becquerel on Capillary Chemistry—Researches on Benzol and its Derivatives—Cause of Tubercular Disease—Daubree on the Classification of Meteoric Stones—Theory of Volcanic Upheavals—Telescopic Views of the Great Nebula in Orion—Election of Adolphe Wurtz, F.R.S., to the Academician's Chair, vacant by the Death of Pelouze.

M. Chapelas-Coulvier-Gravier presented to the Academy a small volume which he published under the title of "Practical Meteorology."

M. Chasles presented to the Academy two letters from the poet Routrou to Cardinal Richelieu. In the first, Rotrou advises the celebrated minister to found, in Paris, a literary society analogous to that of the floral games of Toulouse; in the second he thanks him for having seriously entertained the proposition by founding the French Academy. To these presents M. Chasles added two other letters, one from Routrou to Corneille, and another from Corneille to Routrou. M. Chevreul reminded M. Chasles that he told him one day that he (the latter) was in possession of two autograph letters, from which it resulted that Pascal had discovered and calculated, before Newton, the law of universal gravitation of masses in the inverse ratio of the square of the distance. Pascal was born in 1623, died in 1662, and Newton only made his great discovery in 1665. If it is true that, in documents written by his hand, Pascal had established the law of gravitation, it is certain that he was in advance of Newton. The documents M. Chasles possesses are: the first, a letter written by Pascal to Robert Boyle, the illustrious physician; the other is a note certainly written by his own hand. M. Chasles promised to bring to the Academy, on Monday next, the two precious documents, and to make them the subject of a more explicit communication.

M. Becquerel, sen., read a third communication on capillary chemistry. He pointed out new facts of chemical decompositions taking place under the influence of capillarity, and he thought he has proved that these truly curious phenomena were produced under the triple influence of affinity, capillarity, and electricity. To demonstrate the intervention of electricity, M. Becquerel has made the following experiment: he immersed his *split* bell-glass, containing nitrate of copper, in a second bell containing a solution of monosulphide, as in the first experiments; then he dips the two extremities of a silver wire, one into the nitrate and the other into the monosulphide. A constant electric current is formed: 1. The deposit of silver is made not in the capillary slit, but on the iron; 2. When the wire is removed the deposit is formed in the slit and on the edges along the side of the split bell glass. The capillary action is as powerful as an electrical action. M. Becquerel continues to improve his experiments; for the split bell-glass he substitutes prisms of crystal glass pierced with a small hole; the slit or fissure is replaced by plates of glass with edges in contact, or even by sand; and he has thus obtainedeffects of silvering, gilding, platinising,

and very remarkable deposits of gold, silver, nickel and cobalt.

M. Zinin, of the Academy of Sciences of St. Petersburg, read a *resume* on his researches on benzol and its derivatives, azobenzol, azoxybenzol, &c.

M. Velpeau read a letter in which M. Lebert, of Breslau, states that he thinks he has found the cause of tubercular disease in the shortening of the pulmonary artery.

M. Daubrée enumerated the bases of the classification and methodical arrangement of the collection of meteoric stones and iron of the Museum of Natural History.

M. Edmond Becquerel communicated an observation, of M. Janssen, from which it results that the oscillatory motions of volcanic upheavings are always perpendicular to the faults that can be compared to an opening, the edges of which open and shut by turns.

Father Secchi, of Rome, handed in two telescopic views of the nebula in Orion, made in 1859 and 1865.

The Academy then formed into a committee for the discussion of the claims of the candidates for the chair in the chemical section, rendered vacant by the death of M. Pelouze. The section presented in the first place M. Wurtz, and secondly in alphabetical order, M. Berthelot, and M. Cahours. M. Wurtz, the discoverer of glycol, and compound ammonias, is most likely to be elected unanimously. The discovery of glycol and compound ammonias gained for him the prize of £400. His "Chemical Philosophy" has been translated into many languages—into English by Mr. Crookes, &c.; his claims are of the first order, even in the presence of the innumerable discoveries of M. Berthelot, and the long and glorious labours of M. Cahours.

NOTICES OF BOOKS.

The Alkali Act, 1863. *Third Annual Report by the Inspector, of his Proceedings during the Year* 1866. By Dr. Angus Smith, F.R.S., &c., Government Inspector.

It is gratifying to find that Dr. Angus Smith is able to state in this, his third report, that there has been a further advance in the manner of preventing the escape of muriatic acid gas; and that, although during the last year the escape has been greater in the actual number of tons, it is owing to the increase in the manufacture. The amount of salt decomposed during the first year of inspection was 288,000 tons, during the second 310,000, and during the third it is 371,950. The necessity for inspection is well borne out by many of the facts related in connection with them.

For instance, in one case, where there appeared to be all the ordinary contrivances for condensation, 20·5 per cent of the muriatic acid was found to be escaping. Another test, taken after alterations had been made, with a view of checking the escape, showed the presence of 13·5 per cent. The owner was prohibited from working with these arrangements. He stopped work, and erected a second condensing tower, but the escape was still 15 per cent. The inspector again prohibited work until a remedy was found. The arrangements ultimately were properly made, and at a subsequent inspection the escape was only 1 per cent. Dr. Angus Smith writes—"The struggle with the condensers may be said to have ceased; the circumstances are understood. Our new struggle is with this escape from the works, and of a certain amount of gas which passes through bricks, tubes, and even stone, as well as of that coming occasionally from the mouth of the furnace."

The author remarks upon the way in which the manufacturers have come to regard inspectors. Finding that in many manufactories there was not a sufficient staff with chemical knowledge, the inspector has given advice with regard to the alterations required, and if the changes have been speedily made, has refrained from prosecution. A letter from a manufacturer illustrates the feeling referred to. In the course of it he writes: "It is very annoying to me that you should ever find anything to find fault with, but as our method of working is uniformly the same, and as we have no means of knowing when the condensation is right except from your tests and inspections, I hope you will not be long before you come again, and, if possible, often." The author of the report says: "I consider this letter an indication that the time has now come for throwing aside much of the responsibility which we have taken from the manufacturers, or they will turn round to throw on us the blame of any infraction of the Act committed in their own works." It would appear that the proprietor found that in the visits of the inspector he obtained such valuable advice as to save him the expense of attaching a chemist to his establishment. No doubt great good has been done by the excellent spirit in which the inspections have been made, but now that manufacturers are making greater profits by the larger amount of acid they are enabled to obtain from the same amount of material, and likewise by the saving, in many cases, of the amounts formerly paid as damages, we consider that Dr. Angus Smith, and those gentlemen under his direction, have no longer any need to burden themselves with duties which, as inspectors, they were in no way bound to undertake. The author is evidently not inclined to a radical change in this direction, as the following extract in reference to the peremptory demand of good condensation shows:—"When the habit of condensing or of destroying all noxious vapours has been longer confirmed, this demand may grow to be just and reasonable." In another place he remarks that if the number of works under the inspectors were much increased, there would be no time left in which to consider and advise manufacturers. At the end of the report are a few pages devoted to the consideration of what is meant by a nuisance.

Dr. Angus Smith shows, we think very clearly, an advantage of inspection. This, although a minor one, is of great importance to manufacturers, as they possess one interest, and the public another. It is in reference to the subject of a *nuisance*—a word conveying an excessively vague meaning—that the author draws attention. At present, he says, excepting those factories coming under the Alkali Act, the public are not protected from the manufacturer, neither is the latter protected from the public. Take, in the first place, the case of a householder who suffers from the escape of noxious gases evolved from a nest such as in London is found at Belle Isle. The processes, which may be bad enough when properly carried on, are probably clumsily managed. He must of course be able to fix the nuisance upon a particular factory, and this is one great difficulty. In such cases the evidence is characterised by great uncertainty; even a chemist, as Dr. Angus Smith says, is frequently obliged to trust chiefly to his senses, as he cannot obtain admission to the factory, and therefore the gases may be so diluted where he examines the air as to make it difficult to prove their presence. The following sentence, occurring in the report, exactly expresses our own opinion upon this point:—

"The want of protection to the public lies, in ordinary nuisance cases, in the want of power to enter the works and to make experiments."

In another place the author writes, "Unless chemists can define a nuisance, and have opportunity of examining in cases of complaint, neither the public nor the manufacturer is protected."

Taking now the case of a manufacturer, a case is stated showing that he is liable to be attacked and injured unjustly:—

"It sometimes happens," as the author puts it, "that a neighbour who is peculiarly sensitive, objects to the smell of even well-conducted works; he may be able to say truly that they are to him very offensive, and he may have no idea that, were all men to have an equally acute sense of smell, manufactures would cease. He may, however, care little for such things, and be determined to seek

his own comfort only, and he, therefore, on oath and with truth, says that the smell makes his house unpleasant."

The laws referring to nuisances, we are told, are also vague, owing to the want of precise modes of detecting them.

This is not the case with those which come under the Alkali Act. Here there is complete protection up to a certain point, to both manufacturers and the public. We quote once more to give the opinion of the author, who is necessarily an authority, upon this point. He says:—"It seems to me that the system of inspection protects both sides if the inspector has his direct instructions, as under the Alkali Act, to look for the condensation of a distinct amount. The public is freed from 95 per cent, of muriatic acid by this Act, and the manufacturer is protected from the complaints of the public so far. If a similar fixed point could be adopted in the case of every gas, there would be complete protection to the public and manufacturer on both sides up to that point, occasional mistakes and accidents excepted. It seems to me a most important thing to seek such fixed points, and where they cannot be attained to make the nearest approach to them, so that evidence may be taken by competent persons on the spot, instead of by persons stretching at some distance beyond the works the capacities of their sense of smell."

The Act referring to the manufacture of hydrochloric acid has worked so well that we would urge upon the Government the neeessity of the inspection of all similar manufactures. There can be little question that that the Alkali Act has resulted in benefit to the manufacturers who were brought under its influence. Imagine a manufacturer of hydrochloric acid (we are willing to believe it an exceptional case) allowing an escape of 20 per cent!

In an appendix Dr. Angus Smith describes an apparatus, and the method of using it, for the determination of the speed of air in flues. We must refer those of our readers who may be interested to the original, as the paper is long, and not capable of condensation.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Phenol-group, Contributions to the history of.—L. Dussart. (C = 12, O = 16). Naphthalene, on being heated with sulphuric acid (10 parts of the former to 25 of the latter), is completely converted into sulpho-naphthalic acid, which, on continued heating, changes into disulpho-naphthalic acid. If pure naphthalene has been taken, little sulphurous acid is formed. The salts of disulpho-naphthalic acid are decomposed by fusing potassic hydrate under formation of a new body, the analysis of which led to the formula of the diatomic phenol $C_{10}H_8O_2$. This body is more soluble in water than naphthol; it dissolves readily in caustic potash, which solution is instantaneously decomposed on exposure to air.—(*Comptes, R.* lxiv. 859).

Benzoin, derivatives of (C = 12, O16 =).—M. Zinin. If benzoin is heated with fuming chlorhydric acid to 130°C. under pressure, an oily body is formed, which on cooling solidifies to a crystalline mass. Of this mass about 72 per cent are soluble in ether or alcohol, and this solution, on evaporation, yields crystals of benzil, and a thick yellow oil, insoluble in water, easily soluble in alcohol and ether. The portion insoluble in ether is a new compound which the author calls lepiden, its composition is $C_{28}H_{20}O$. It is insoluble in water, readily soluble in benzol. It melts at 175°, and evaporates at 220°. Potassic hydrate, either solid or in alcoholic solution, does not act upon lepiden. Nitric acid and chromic acid convert it into crystalline oxy-lepiden $C_{28}H_{20}O_2$, which is insoluble in water, nearly so in ether, readily soluble in benzol. Its melting point is 220°. Zinc and acetic acid reduce it again to lepiden. A bromine substitution compound of lepiden, $C_{28}H_{18}Br_2O$, has been obtained by adding bromine to its solution in acetic acid.—*Acad. Petersb.* xi. 151).

Platinic and Auric Chlorides, Combinations of.—Weber. (O = 8). The yellow crystals which are obtained on adding fuming nitric acid to a solution of platinic chloride have the composition $PtCl + NO_2Cl + HO$. They dissolve in water with disengagement of NO_2. From a solution of platinic chloride in chlorhydric acid (free from nitric), red brown crystals separate on evaporation under the dessicator, which have the composition of Marignac's double chloride of platinum and sodium, but containing H in place of Na.,—$PtCl_2 + ClH + 6HO$. A similar compound has been obtained with auric chloride $AuCl_3 + HCl + 6HO$.—(*Acad. Berl.*, Feb., 1867).

Action of Chloride of Sulphur on Metals and Sulphides—(S = 16.)—E. Baudrimont has studied the action of sulphurous chloride (S_2Cl) on various metals and sulphides. The reaction in which metallic chloride is formed, and sulphur precipitated, takes place most readily with those metals, the chlorides of which are volatile, but is prevented altogether in the case of magnesium and sodium.—(*Comptes. R.* lxiv., 368).

Benzylic, bromide, and bromtoluol.—F. Beilstein. The action of bromine on toluol is analogous to that of chlorine on toluol. Benzylic bromide (not free from bromtoluol) is obtained when vapours of bromine are made to act upon boiling toluol, and bromtoluol (free from benzylic bromide), when bromine in presence of sodium acts on toluol, either cold or hot.—(*Zeitschr. Chem.* N.F., iii. 281.)

Phenylene brown.—Caro and Griess (C = 12). Experiments of Hofmann, Martius, and Holle, have shown that β phenylene-diamine on being acted upon by nitrous acid is decomposed with formation of a brown substance, which under favourable conditions may be obtained as a crystalline body of basic nature. If to a cold, dilute, neutral solution of phenylene-diaminic chlorhydrate is added a neutral solution of a nitrite, a crystalline dark-red mass is precipitated. Washed with water and treated with strong chlorhydric acid, it first dissolves and then the chlorhydrate of the new base separates as a tarry liquor. The latter decomposed in aqueous solution by ammonia, yields the dye in a crystalline state. The phenylene-brown conists chiefly of a new base of the composition $C_{12}H_{13}N_5$, and is derived from β-phenylene-diamine according to the equation:

$$2C_6H_8N_2 + NHO_2 = C_{12}H_{13}N_5 + 2H_2O.$$

Its constitution is considered to be $C_{12}H_7(NH_2)_3N_2$, that is, triamidoazobenzol.—(*Zeistchr. Chem.* N.F., iii. 278.)

Crystalline Chromic Oxide.—R. Otto has obtained chromic oxide in the crystaline state, by passing a current of hydrogen over potassic bichromate. The salt is reduced to potassic chromate, which serves as the medium in which the oxide crystallises.—(*Ann. Chem. Pharm.*, cxlii. 102.)

Ethyl-pyrophosphoric Acid.—G. Dilling (C = 6, O = 8). Phosphoric anhydride at ordinary temperature does not act upon zincic ethide; heated together in sealed tubes to 140° C. zincic ethyl-pyrophosphate is formed, besides other products. The basic salt of this acid has the composition,

$$2BaO\left\{\begin{matrix}C_4H_5\\C_4H_5\end{matrix}\right\}P_2O_6, O_2$$

Ethyl-pyrophosphoric acid may be considered as a derivative of pyrophosphoric acid in which one or two atoms of oxygen are replaced by ethyl.—(*Zeitschr. Chem.*, N.F. iii. 266.)

Creosote.—E. Probst, in a preliminary communication states that he has obtained pyrocatechin from beech-wood-creosote by melting the latter with an excess of potassic hydrate. He reserves to himself a more complete investigation of this subject.—(*Zeitschr. Chem.*, N. F. iii. 280.)

Gallic, Pyrogallic, and Oxyphenic Acids, Bromo-derivatives of.—H. Hlasiwetz (C = 12, O = 16). These three acids combine readily with bromine, forming the following substitution-compounds:—Bromogallic acid,

$C_7H_4Br_2O_5$, readily soluble in hot water, in which solution ferric chloride produces a brilliant violet, ammonia a red coloration. Bromopyrogallic acid, $C_6H_3Br_3O_3$, is somewhat less soluble in water, but gives the same reactions as the former. Bromoxyphenic acid, $C_6H_2Br_4O_2$, is insoluble in water, readily soluble in dilute alcohol; its solution assumes a dark blue colour on addition of ferric chloride.—(*Acad. Wien.*, 55, 1867.)

Titanic Iodide.—P. Hautefeuille. This compound is readily obtained by acting upon titanic chloride with hydriodic acid. When purified by repeated sublimation in a current of hydrogen it forms a brittle red-brown mass, which fuses at 150°C, and crystallises on cooling. It boils above 360°, and its vapour density, taken at 440°, was found = 18·054; calculated for 2 volumes, it should be 19·334. It is soluble in water, but the solution soon decomposes with precipitation of titanic acid.—(*Bull. Soc. Chim.*, vii. 201.)

Chloric Acid, determination of.—C. Stelling (O = 8). Potassic chlorate is reduced to chloride on being treated with ferrous oxide, according to the equation, $KO,ClO_5 + 12FeO = KCl + 6Fe_2O_3$. This suggested the following method for the determination of chloric acid:—To a solution of the chlorate is added ferrous sulphate and an excess of potassic hydrate; the mixture is boiled and filtered, and in the filtrate the chlorine determined in the usual manner.—(*Zeitschr. Amalyt. Chem.*, vi. 32.)

Cobalt and Nickel, Atomic Weights of.—Cl. Winkler has determined the atomic weight of these metals according to the following method:—The metals were prepared in a state of perfect purity; the cobalt, by reduction of repeatedly recrystallised purpureo-cobaltic chloride in a current of hydrogen at a high temperature. The nickel, by adding to a solution of the commercial carbonate in chlorhydric acid sodic hypochlorite, and treating the liquid in this manner again so long as any cobalt could be detected in it; the solution was then purified from traces of copper and arsenic and precipitated with sodic carbonate. The carbonate was converted into chloride, and sublimed in a current of chlorine, and lastly reduced in a current of hydrogen.

Weighed quantities of the metals were then immersed in a perfectly neutral, concentrated, cold solution of sodio-auric chloride, and the weight of the precipitated gold determined. The mean of five experiments with cobalt gave the number 29·496. The mean of four with nickel, the number 29·527.

The atomic weights of these metals may therefore be taken as identical, *i.e.*, 29·5.—(*Zeit. Analyt., Ch.*, vi. 18.)

CORRESPONDENCE.

USE OF DISTILLED WATER.

To the Editor of the Chemical News.

Sir,—In Mr. Quin's report upon the Paris Exhibition, reference is made to the use of distilled water at the Wallaroo Copper Mines in South Australia, stating that until tanks for collecting rain-water had been constructed, "perhaps for the first time in the history of the world, there was a population of some thousands, with all their horses, cattle, sheep, &c., drinking *aqua distillata*." As many of your readers may not be aware of the fact, it may be interesting here to mention that in the rainless region of the Pacific coast of South America, the entire population of the country, between about the 18th and 28th parallels of south latitude, or some 600 miles from south to north, including the important towns of Caldera, Cobija, Iquique, Pisagua, and several minor ports, have for many years derived their supply of potable water from the sea water of the Pacific, distilled in greater part by coal imported from England, and costing above £3 per ton.

Not only is a population of many thousand inhabitants principally engaged in the mines of this district, as well as a still larger number of beasts of burden, and other animals, supplied from this source, but even the locomotives on the Copiapo and Caldera railway, and some steam engines for other purposes, are actually driven with distilled water. For a distance of some thirty to fifty miles inland from the coast, very few natural springs are met with in this rainless desert, and when met with they are seldom sufficiently free from saline matter to be potable.

D. F.

MISCELLANEOUS.

On the Manufacture of Zinc.—C. Trainer. Comparison of the Belgian and Silesian distilling furnaces gives ths following result. The Belgian furnaces with some 60 effective retorts in 7 to 8 horizontal rows require less fuel, the process is more intense, is finished sooner, and yields more. However, they require a full-flaming coal, and the consumption of retorts is greater; and when breakages occur the under retorts often suffer. The attention to these furnaces requires very intelligent and experienced workmen, as they have to keep up an equal temperature of all the retorts, above and below, front and back. On the other hand, the Silesian furnaces require less skilful workmen, and less vessels, as they last longer, while the consumption of fuel is larger, but a less open burning coal may be used. The latest improvements in the Silesian furnaces for the purpose of saving fuel (two rows of muffles above each other, and a downward flame) require a free burning coal as well as more expert workmen. A greater durability is ascribed to the Silesian furnaces than to the Belgian; this advantage, however, is doubtful after having introduced considerably improved arrangements in the front wall of the Belgian furnaces. Such improved furnaces lasted two years, at an taverage, near Iserlohn. It is advantageous to the durability of the furnaces for them always to be attended by the same workmen. The Silesian process extracts more zinc from the ores on account of their longer stay in the furnace and the less amount of breakage of the distilling vessels, whilst the Belgian furnaces have, for a fixed time, greater productiveness. When the ore forms tough slags the Silesian method is preferable. Trials of zinc-melting in blast-furnaces have not been successful. It would lead to considerable advantage if the distillation of the zinc-ore could be effected in a large flat muffle, which could be sufficiently heated and would not crack. Such an apparatus, on the one side with openings for charging, on the other with vessels for condensation, would require a less amount of fuel.—*Berg. und Hutttm, Zeitung* 1867, No. 24.

Mercerising Cotton.—To Mr. Mercer must be attributed the discovery of the peculiar action of caustic, soda, and sulphuric acid upon cotton. This singular process, now called "mercerising" has the effect of untwisting the normally twisted flattened tubes of cotton filaments and converting them into cylindrical tubes. When colours are applied to the cotton so treated, they pass more readily through the minute pores of the tubes and are precipitated in denser layers in the interior of the latter, whereby darker and more permanent shades are produced. Calico so treated become greately increased in strength,, and though hitherto no large quantities of cloth thus prepared have been printed, owing to the expense of preparation, advantage has been taken of the process to prepare the cotton fabric used in the production of of the endless web known to calico printers as the india rubber blanket, which, when made with prepared calico, is rendered much more durable—*Proc. Lit. Phil. Soc., Manchester.*

Determination of Bismuth in Lead Alloys.—(Patera). The alloys are dissolved in nitric acid, the solution deluted with water, and the bismuth precipitated by a strip of pure lead. The precipitated bismuth, black of colour and in the state of powder, is quickly washed off the lead, the solution of lead is decanted; the bismuth is then washed first with water and then with alcohol, filtered on a weighed filter, dried and weighed.—*Berg geist*, 1867, No. 28.

Blasting with Sodium.—Experiments are now being made, in the Isle of Man and elsewhere, to ascertain the value of sodium, in contact with water and other substances, for blasting purposes.—*British Journal of Photography.*

An Old Anæsthetic Revived.—An enterprising American dentist advertises that he now takes teeth out painlessly by merely causing the patient to inhale the *constituents of the atmosphere—oxygen and hydrogen—chemically combined.*

Partzite.—This mineral, discovered by Dr. Part in 1865, has been investigated by Albert Arents. It occurs in amorphous masses, generally without lustre. Fracture, varies from conchoidal to even; colour, yellowish green to blackish green and black; sp. gr. = 3·8; hardness, 3·4. Before the blowpipe on platinum it is melted, but with difficulty, to a black slag; on charcoal, especially with addition of carbonate of soda and powdered charcoal, a metallic button is easily obtained much resembling pure antimony. Sulphuric, nitric, or hydrochloric acid decomposes the mineral. An analysis gave number corresponding to the formula:

$$(CuO,AgO,PbO,FeO)_3SbO_3+3HO$$

Partzite occurs with argentiferous galena.—*Silliman's Journal*, May 1867.

Action of Water upon Carbohydrates at an Elevated Temperature.—O. Loew. Cane sugar at 160°C. yields levolosan and glucose; at 180° caramelan; at 200° caramel, assamar, and carmelin; and at about 250° is totally decomposed. The author finds that the presence of water makes a great difference. Sugar is perfectly decomposed when heated with water in a sealed tube to 160°, the water seeming to act as an acid. Sugar heated with alcohol in a sealed tube to the same temperature remains unaltered. Sugar heated with baryta water in tubes is not decomposed at 170°C. Water acts in the same way upon other "carbohydrates." Starch, gum, and milk sugar with water are decomposed by five hours' heating at 70°C. The products are formic acid, carbon, and carbonic acid.—*Silliman's Journal*, May, 1867.

A Catastrophe Averted.—In the course of last winter the river Irwell rose nearly twenty feet above its ordinary level, and flooded the works of the Magnesium Metal Company on the Salford side to a depth of about seven feet in every part. There were then from three to four hundred-weight of sodium in stock, and, soon after the commencement of the flood, the room in which the sodium was stored was two feet deep in water; but, as it rained in torrents, it was then considered best not to run the risk of attempting to move it off the premises. The sodium was stored in long narrow jars, with loosely-fitting covers, made air-tight by allowing the bottoms of the lids to rest in a circular groove filled with oil. As the flood did not abate, and the position began to grow more dangerous, one of the men volunteered to go on the roof of the sodium shed and watch the water rise, and for hours he lay upon the roof in a soaking shower of rain, watching the sodium jars. Inch by inch the water rose, and at last, when it was only half a foot from the top of the jars, he drew his head out of the hole in the roof where it had been sticking so long and summoned the rest of the men. They unslated the roof of the store room, let themselves down into the water, now reaching nearly to their armpits, and removed the sodium lump by lump into other vessels placed among the rafters of the roof. By accident one little ingot of sodium fell into the water, causing the courage of the men to falter; but the lump fortunately only fumed and fizzed, and dissolved away without exploding. After the flood was over the Magnesium Metal Company built a platform near the roof, on which all sodium is now stored. We have not heard what bonus the Company voted to the men who removed the sodium, especially to the one who stuck to the top of the roof like a limpet to a rock in a storm, but doubtless it was something handsome.—*British Journal of Photography.*

NOTES AND QUERIES.

Chemical Calculus.—Sir,—Allow me to point out a correction which it would be desirable to make in your otherwise excellent abstract of my note at the Royal Society on the "Chemical Calculus." In the abstract my translation of Brodie's formula for hydrochloric acid, is given thus:—

$$H_2\,\frac{Cl}{H}$$

instead of thus—

$$H_2\frac{Cl}{H}$$

And in like manner the line which I employ between the numerator and denominator of other symbols in the form of division is omitted. My intention was to use the symbol of division to denote decomposition, just as the symbol of multiplication is habitually employed in chemical formulæ to denote combination. I notice that by some accident the number 73 is given as the molecular weight of hydrochloric acid, instead of 36.5.—Alex. W. Williamson.

Acids from Palm Oil.—Sir,—I wish to know the quantities of hard, white palmitic acid and liquid oleic acid which are usually procured from one ton of average palm oil by saponification, followed by distillation and cold and hot pressure. 2ndly. What proportions of the fatty acids are procured from tallow by the lime process, as adopted generally on the continent. I find sundry loose statements in various technical publications, but as they differ so widely I am anxious to learn from some practical person what are the real results obtained in actual working.—Delta.

Refrigerating Machine.—Sir,—Is there any manageable machine in use for manufacturing purposes, for cooling mother liquors.—P.

Distilling Oil.—Sir,—Can any of your readers inform me of any work that treats of oil distilling. I can find no information in any work on chemistry. I want information on rosin oil distilling and refining, and the improvements made in this branch of business. What is the best process for refining rosin oil, nearly destitute of smell and of a blueish colour?—H. J.

Cheap Grease.—Your correspondent, J. S. W., should try a grease made from the last oil or grease obtained during the distillation of coal tar, or he could try a mixture of rosin and the grease refered to. If your correspondent added a small quantity of the commonest soap to the grease, he would find a great improvement. This would make the cheapest grease for colliery and other purposes.—H.

Charcoal Biscuits.—Sir,—To the receipt given last week add two ounces of levigated cedar wood charcoal, to be mixed intimately with the flour.—Correspondent.

ANSWERS TO CORRESPONDENTS.

*** *Owing to the growing demands upon our limited advertising space it has been rendered necessary to omit the Table of Contents in future from the front page of the* Chemical News.

We have been requested to correct an error which has been very generally made by the English Press, (the Chemical News included). In the list of firms which have gained silver medals at the Paris Exhibition, the well-known firm of *Morson and Son* has been misprinted *Mawson.*

J. S.—We have been unable to find the paragraph in question; about what date did it appear?

W. H. A.—There is no difficulty in taking ink stains from paper. Most acids will effect the desired object. The principal thing to be attended to, is to remove every trace of the acid from the paper after it has done its work. This is a difficult thing to do properly, and its neglect is the cause of the rotting so often complained of after the removal of ink-spots.

W. J. S.—The term photograph is the generic name applied to all pictures taken by the agency of light. A daguerreotype is, therefore, as much entitled to be called a photograph, as a paper print from a collodion negative.

A Druggist.—Picrate of potash has been used by Braconnot as a substitute for quinine, in intermittent fevers; the dose is from two to five grains. It is said to answer very well, but makes the patients as yellow as guineas.

D. R.—Sulphate of baryta is soluble in hot strong sulphuric acid, but water precipitates it.

A Manufacturer.—If you advertise in our pages you will be certain to receive many answers.

S. Johnson.—To dye silk with gold, immerse the stuff in a bath of chloride of gold for ten minutes, then wring and dry. Expose to the sun-light, when the colour changes to a beautiful lilac.

Papering Damp Walls.—Sir,—One of the walls in my house is so damp that the paper will not stick; it mildews and peels off within a few months. I am not a chemist, but I should think that some of your correspondents will be able to suggest a remedy.—R. A., Dudley.

Communications have been received from, F. A. Abel, F.R.S.; Dr. Letheby; W. B. King; Morson and Son; H. B. Condy; Sir B. C. Brodie, Bart. F.R.S.; Dr. F. C. Calvert, F.R.S.; B. Westermann and Co. (New York); G. Hill; H. Woodward; D. Forbes, F.R.S.; G. F. Rodwell; E. Beanes; Dr. Odling, F.R.S.; W. Bright: Albright and Wilson, with enclosure; J. Kayess; C. R. C. Tichborne; Muspratt Bros.; Dr. Oxland; John Tilley; Professor Williamson, F.R.S.

Books Received: "Researches on Gun Cotton," by F. A. Abel, F.R.S., being the Bakerian Lecture for 1867.

THE CHEMICAL NEWS.

Vol. XVI., No. 398.

ON THE

RECOVERY OF SULPHUR FROM ALKALI WASTE.

By LUDWIG MOND.

Alkali waste, black ash waste, tank, vat, or blue waste, are the different names of the insoluble residue obtained by the lixiviation of artificial crude soda, or black ash, produced by Leblanc's celebrated process for the manufacture of alkali, which, in spite of innumerable attempts to supersede it, still furnishes almost alone the very large quantities of alkali at present consumed, and has undergone hardly any essential change since its illustrious inventor introduced it about eighty years ago. This superiority to all other known processes is undoubtedly, to a great extent, due to the production of the above named waste, on account of the valuable property it possesses of separating completely and easily from the alkali in the black ash by lixiviation. Nevertheless this waste has been always regarded as the greatest drawback to this important manufacture. Every ton of alkali produces no less than 1½ tons of dry waste, and the enormous quantities thus obtained are generally deposited in the neighbourhood of the works, often forming hills of considerable height. In damp weather especially this waste evolves large quantities of sulphuretted hydrogen, that most noxious and most disagreeable of all gases, sadly annoying the surrounding population; and, moreover, the rain and ground-water coming into contact with it dissolve out considerable quantities of yellow liquor containing hydrosulphide and polysulphide of calcium, which poisons the water of all wells and rivers to which it has access. These evil results are altogether due to the sulphur contained in the waste, which amounts to no less than 80 per cent of all the sulphur used in the manufacture of alkali, and which represents, of course, a very considerable value. All efforts to recover this sulphur by a cheap and simple method, and thus also to do away with the nuisance of the waste, have until lately failed in their object, though a great many distinguished chemists and intelligent manufacturers have for the last thirty to forty years devoted much time and expense to this important task, amongst whom Mr. William Gossage (to whose well known labours we owe so many valuable improvements in the manufacture of alkali) takes again the first place. A considerable number of methods have been described and patented, none of which, however, have overcome the principal practical difficulty of the question,—to treat the large quantities of waste without employing too much labour and too large a plant.

It is only within the last few years that sulphur has for the first time been regularly manufactured from alkali waste, by a process of the author's invention, and so rapid has since then been the progress of this new industry, that at this year's Paris Exhibition no less than seven works exhibit sulphur recovered from waste by three different methods, all of which have been patented in England as follows:—L. Mond, 8th September, 1863; M. Schaffner, 23rd September, 1865: P. W. Hofmann, 9th April, 1866. All these processes are based on the same principle—viz., conversion of the insoluble sulphide of calcium in the waste into soluble compounds by bringing the waste into contact with air in order to oxidise it. Lixiviation of the oxidised mass and precipitation of the sulphur in these liquors by a strong acid, in practice of course muriatic acid.

This principle has already been described by W. H. Leighton, in his patent for improvements in converting sulphate of soda into sub-carbonate of soda, dated October, 1863. He proposes to allow waste to remain in the vats until it heats and gives off smoke, then to lixiviate and to precipitate the sulphur from the liquor thus obtained by muriatic acid. It is, however, not probable that he ever worked his process out, no account of it being found, except that in the Register of Patents. In 1852 W. S. Losh took out a patent for obtaining hyposulphite of soda by exposing waste in heaps to the atmosphere, lixiviating it, adding carbonate of soda to the liquor, and crystallising. This process has ever since been worked very successfully at the Walker Alkali Works, near Newcastle, where about six tons of hyposulphite of soda per week are produced. Being engaged in researches on the different processes for sulphur recovery by Mr. Gossage and others in the summer of 1860, my attention was drawn to Mr. Losh's patent, and I at once started a series of experiments in order to ascertain whether, and under what conditions, a quantity of hyposulphite of lime could be obtained by oxidation of the waste, which would render practicable the extraction of sulphur on a large scale, and its recovery by means of muriatic acid. I soon found out that the formation of soluble sulphur compounds in the waste increased only up to a certain maximum, when sulphur to the extent of about 5 per cent of the weight of the dry waste could be extracted by lixiviation, and that this quantity decreased by exposing the waste any longer. When these soluble compounds, however, were washed out, the waste oxidised quite as well a second time, a similar quantity of sulphur being obtained again, and this treatment could be advantageously repeated even a third time.

The waste I used for these experiments being lixiviated by a singular method, since abandoned, was, however, so dense that all efforts to oxidise it in heaps, or by forcing air through it, failed, so that I had to expose it in shallow layers on shelves. This process was patented in France in December, 1861, and in England in August, 1862, and sulphur to the extent of 12 per cent of the waste has been obtained by it in considerable quantities in a German alkali works.

Coming to England, in the autumn of 1863, I very soon found, however, that the enormous quantities of waste to be treated, and the high rate of wages, made this process quite impracticable here, and that the waste produced by the excellent process of lixiviating black ash, in general use in this country, was very likely to allow of a much more simple treatment. I tried again to oxidise it by forcing air through it, and succeeded so well that the time necessary to oxidise and lixiviate the waste, which had previously been six to eight weeks, was soon reduced to 60 or 80 hours, and that manual labour was almost altogether avoided by performing these operations in the same vat in which the waste was produced without moving the latter. These facts led to a new process, which was patented the 8th of September, 1863, since when there have been no alterations in the main features of the process described in my specifications of that date. In place of the set of four vats, generally in use for lixiviating black ash, I employ a set of ten or twelve. All of these are connected by pipes in the usual way, so that the soda liquor runs from the bottom of one vat to the top of the next one, and by special pipes and taps which allow the sulphur liquor to run out of the bottom of each vat to the top of any other vat in the set. Besides this, they are provided with extra taps and shoots to convey the sulphur liquor to wells or setters. The lower parts of all the vats are connected with a fan, capable of producing a presure of about 7 inches of water by pipes with dampers, which regulate the quantity of air passing through. A silent fan of Schiele's construction, 20 inches diameter, price £10, propels a sufficient quantity of air for the treatment of the waste resulting from 100 tons of salt-cake per week. Four of the vats are always filled with black ash in the course of lixiviation, the other six or eight with waste to be treated according to my invention. As soon as the black ash is completely spent and the weak liquor well drained off, the connection with the fan is opened. The waste soon begins to heat, the

temperature gradually rising above 200° F., and gives off quantities of steam, becoming greenish and afterwards yellow on the top, gets more and more dry, and would take fire if the air was passed through long enough. The period at which oxidation should be stopped, and the passing of air discontinued, so as to give the best results, must be ascertained in each works by experiment, and varies according as much or little hyposulphite in the liquors is desirable. In the beginning of the action, hydrosulphide and bisulphide of calcium are formed, which are afterwards oxidised into hyposulphite. A part of the hyposulphite is again decomposed into sulphur and sulphite, which is very insoluble and cannot be extracted by lixiviation. Carrying the oxidation too far would therefore entail a serious loss. On an average, the time of exposure will be limited to between 12 and 24 hours. The waste is now lixiviated systematically with cold water, the weaker liquors passing from one vat to the next one in course of lixiviation, so as to obtain only strong liquors, which operation can be easily performed in six to eight hours. When this lixiviation is finished, air is again passed through the waste in exactly the same way as before; the waste is again lixiviated, and the same treatment repeated a third time. The vat is then ready to be cast, and is again filled with black ash. When the operations have been conducted well sulphur equal to about 12 per cent of the weight of the salt-cakes used in making black ash is obtained in solution from the waste. The waste contains only traces of sulphide of calcium, and is principally composed of carbonate of lime, sulphite and sulphate of lime, which, far from being noxious, make the waste, on the contrary, a valuable manure. In separating the sulphur from the liquors thus obtained, by adding muriatic acid, I met with much more difficulty than I had anticipated from apparently so simple a reaction.

(To be continued.)

ON THE APPLICATION OF THE BLOWPIPE TO THE QUANTITATIVE DETERMINATION, OR ASSAY OF CERTAIN METALS.

By DAVID FORBES, F.R.S., &c.

(Continued from page 2).

Silver Assay.

I. A. Metallic Alloys capable of direct Cupellation.

b. Consisting chiefly of silver: native silver, bar, test, and precipitated silver, retorted silver amalgam, standard silver, silver coin, and other alloys of silver with gold and copper.

These alloys may be at once fused with lead on the cupel itself, and the operation finished as before described. In general, however, it is better to fuse the weighed assay previously with the requisite amount of pure lead and a little borax-glass, say from a quarter to half the weight of assay, in the reducing flame at a low heat on charcoal until the globule commences to rotate. This ensures having a perfectly clean button of silver-lead, which is then cupelled in the ordinary manner.

In most cases the quantity of lead to be added need not exceed that of the weight of the alloy, but when several percentages of copper are present in the assay, as in case of many coins, &c., the lead should be increased to some three, or even five times the weight of the assay in proportion to the amount of copper actually contained in the substance under examination, and which will be treated of more at length under the head of copper-silver alloys.

When no more lead has been added to the assay than its own weight, the cupellation may be concluded in one operation by inclining the stand, and so moving the globule on to a clean part of the cupel; but when more copper is present, it is preferable to concentrate first and cupel subsequently, in order thereby to reduce the cupellation loss to its minimum.

In the concentration as much copper as possible should be slagged off with the lead, which is effected by inclining the cupel somewhat more than usual, so that its surface may be less covered up with the litharge and exposed as much as possible to oxidation, by which means the litharge, as it forms, is enabled to carry off more of the copper contained in the silver lead.

Should the silver globule after cupellation show indications of still containing copper, as before noticed, when treating of cupellation, a small quantity of lead must be fused along with it, and the cupellation finished as usual.

As at the present time no means are known by which silver can be separated from gold by the use of the blowpipe, in all cases of alloys containing gold, this metal remains to the last along with the silver, and the result in such cases always indicates the combined weight of both these metals contained in the alloy under examination. The employment of the humid assay must be resorted to for effecting their separation:—

c. Containing chiefly copper: native copper, ingot, wire, or sheet copper, cement copper, copper coins, copper-nickel alloys.

Under the most favourable conditions in cupellation, the amount of lead requisite when converted into litharge to slag of one part of copper along with it as oxide, amounts to between seventeen and eighteen parts its weight. In the blowpipe assay it is usual to add to any cupriferous alloy an amount of pure lead equal to twenty times the amount of copper contained in the alloy, in order to ensure the whole of the copper being separated in the lithage. In the case of nickel the amount of lead required is somewhat less than with copper, but in practice the same amount of lead may be employed.

When the copper is quite clean the requisite amount of lead may be added to it in a single piece on the cupel, fused and cupelled as usual, after previous concentration of the silver lead to a small-sized globule.

It is generally found, however, that traces of iron, slag, gangue, or other foreign matter is present; and, consequently, it is usually advisable to fuse the assay along with the requisite amount of lead, and about one half its own weight of borax-glass in the reducing flame, until the whole of the substance is seen to have perfectly combined or alloyed with the lead, and the globule has come into brisk rotation, whilst at the same time no detached metallic globules are seen in the borax-glass.

The concentration of the silver lead and cupellation are then conducted as usual, taking care when concentrating to incline the cupel-stand so as to expose as much of the metallic surface of the melted globule to the oxidising action of the air as possible, with a view of enabling the litharge whilst forming to carry off as much copper along with it as possible.

Should the silver globule obtained after cupellation spread out, or appear to the eye more flattened than usual with globules of pure silver, it indicates that some copper still remains, and a small piece of assay lead (½ to 1 grain weight) should be placed alongside it whilst still on the cupel, fused together, and the cupellation finished on a clean part of the same cupel as usual.

Precipitated or cement copper, especially that which is in the crude state, and has not been melted and run into ingots, is often very impure, containing so much iron, lead, arsenic, earthy matter, &c., as not to admit of direct cupellation, and in such case should be treated as pertaining to class B. *a.*:—

B. Mettalic Alloys incapable of direct Cupellation.

a. Containing much copper or nickel, with frequently some little sulphur, arsenic, zinc, iron, cobalt, &c., as unrefined or black copper, brass, German silver, &c.

As the presence of these extraneous matters would interfere with the cupellation either by causing a loss of silver-lead projected from the cupel upon the evolution of the volatile substances present, or by forming oxides which could not be absorbed by the cupel, it is necessary to eliminate such substances by a scorification with borax on charcoal previous to concentration or cupellation.

In the case of unrefined and black copper, the portion used in the examination is placed in the scoop with twenty times its weight of assay lead, and its own weight of powdered borax-glass, mixed with the spatula, and transferred to a soda-paper cornette. It is then fused on charcoal in the reducing flame, which should be constant and uninterrupted, until all particles have completely united, and a brisk rotation sets in, which is kept up for a short time, when the silver-lead globule, which should appear bright on the surface after cooling, is concentrated and cupelled precisely as is directed under A. *c.* By this preliminary scorification the sulphur, arsenic, and zinc are volatilised, and any lead, cobalt, or iron slagged off into the borax-glass.

In the assay of brass and German silver, the quantity employed is fluxed with its own weight of borax-glass, but only requires ten times its weight of assay lead. The operation is commenced as before, but the globule is kept somewhat longer in rotation (always keeping the flame directed only on to the borax-glass), so as to allow the zinc present to be completely volatilised, which is evident when the surface of the silver-lead becomes bright, on which the heat is increased for a few moments to expel the last traces of that metal, and the silver lead thus obtained is concentrated and cupelled as before.

The silver globule obtained from the cupellation of substances rich in copper generally requires the addition of a small quantity of lead and re-cupellation (as before described), in order to ensure its freedom from copper.

ON CROOKESITE,

A NEW MINERAL CONTAINING THALLIUM.

By M. A. E. NORDENSKIOLD.*

THE long abandoned mine of Skrikerum is well known to chemists and mineralogists as the spot where seleniferous minerals were first discovered. The richness of the Stockholm museum in seleniferous minerals induced me to re-examine these combinations. During this research I have discovered that the new metal thallium exists in small quantities in eukairite and berzelianite; but, at the same time, I found in Mosander's collection some specimens of a mineral containing as much as 19 per cent of thallium, which I have named *Crookesite*, after the discoverer of the metal. This mineral is for thallium what eukairite was for selenium.

Crookesite forms small coherent, opaque masses of metallic lustre, has a lead-grey colour, and sufficiently compact to admit of its ready separation from the grains of eukairite and the powder of berzelianite. I have observed no trace of crystallisation in the mineral. In tenacity and hardness it resembles chalkosine. Its specific gravity = 6·9.

Before the blowpipe crookesite fuses easily, forming a lustrous green-black enamel; the flame is coloured intensely green. It is insoluble in hydrochloric acid, but nitric acid dissolves it readily and completely.

Analysis led to the formula

$$(Cu,Tl,Ag)Se,$$

which requires—

Copper	45·76
Thallium	17·25
Silver	3·71
Selenium	33·28
	100·00

The small quantity of silver is derived from a trace of eukairite.

Hitherto only a few specimens of crookesite have been found in the mineralogical collection of the Stockholm museum; but it is to be hoped that more may be found upon searching in the mine of Skrikerum.

* *Ofversiht of Knolg. Vertenscapsakademiens forhandlingar.* No. 10.

ON THE SUPPOSED NATURE OF AIR PRIOR TO THE DISCOVERY OF OXYGEN.

By GEORGE FARRER RODWELL, F.C.S.

(Continued from Vol. XV., p. 313).

XVII. Denys Papin.—We have previously considered the labours of the Royal Society and of the *Academie des Sciences* from the time of the foundation of those societies to the year 1673; during the succeeding decade we find scarcely one paper of importance relating to the air, either in the "*Philosophical Transactions*" or in the "*Memoires de l'Academie.*" The science of pneumatics had grown so rapidly during the first twenty years of its existence, that it now somewhat slackened its pace; it is impossible for a science to be uniformly progressive, and the preceding period had been brilliant in discoveries, which had succeeded each other with rapidity. The discovery of the pressure of the air had been immediately followed by the tentative and crucial experiments of Pascal, then came the experiments of Otto Von Guericke, Boyle, Hook, and the Academia del Cimento, while pneumatic chemistry received its first start in life from John Mayow. Such a cluster of discoveries could not be looked for again, and we are consequently prepared to find scientific literature somewhat sparsely supplied with pneumatic researches during the succeeding period.

In the *Philosophical Transactions* for 1675 there are several papers by Christian Huygens* and Denys Papin†. In one of them, entitled "*Pneumatical Experiments made with the air-pump,*" we have an account of some experiments relating to the mutual reaction of different bodies in vacuo, and the observance of the tension of the evolved gas; thus, nitric acid was poured upon copper filings, and sulphuric acid upon carbonate of potassium, and it was noticed that while the gas produced by the former reaction remained at the same tension for any length of time, that produced by the latter reaction vanished completely in the course of twenty-four hours. It is to be borne in mind that a water gauge was employed for measuring the tension, moreover water was used to render the piston of the air-pump tight, and not unfrequently found its way into the receiver; the disappearance of the one gas was therefore due to its being absorbed by water, while the other remained unaffected. Again, in the *Philosophical Transactions* for 1676 we find two pneumatical papers jointly by Huygens and Papin; in the second of these there is an account of an attempt to determine the volume of gas produced by the explosion of gunpowder. In order to ascertain this a known weight of gunpowder was placed in a receiver of known capacity, together with a gauge for showing the tension of the evolved gases; when the receiver was well exhausted, the gunpowder was fired by means of a lens. It was then calculated that one-fifth part of gunpowder consists of gas, which is "compressed" in the powder to one-three-hundredth of its volume when free. This gas, the authors remark, must come from the nitre, as sulphur yields no permanent gas when it is melted in vacuo.

In the *Memoires de l'Academie*, the only paper relating to our subject, which appeared during the decade, is by Mariotte; it was communicated in 1679, and is entitled "Sur la Nature de l'Air." It relates chiefly to the absorption of air by water, and the experiments are for the most part modified forms of previous experiments. At the conclusion of the paper, Mariotte states his con-

*Born 1629, died 1695. †Born 1647, died 1714.

viction that the air is not colourless, but pale blue, as may be observed when it is viewed in mass. It is for this reason that the sky is blue, and the tops of mountains bluish. In support of the theory, he adduces the following experiment:—"Que l'on rescoive sur une moitié d'une feuille de papier blanc la lumière d'une chandelle, et sur l'autre celle de la Lune, séparées par quelque corps qui les empeche de se méler, la partie du papier éclairée par la chandelle paroitra rougeatre, parce que cette lumière a effectivement beaucoup de cette couleur, et la partie éclairée par la Lune sera bleue, parce que cette lumière a traversé toute l'atmosphere, et y a pris cette teinture." *

Huygens and Papin have been mentioned above as the joint authors of several papers. Papin, for some length of time, studied physics under the direction of Huygens, and assisted him in many of his researches, but, after awhile, their pursuits became somewhat divergent, for whilst the latter devoted his attention chiefly to pure mathematics, and to optics, the former showed a greater aptitude for mechanics and pneumatics.

Papin first came prominently before the scientific world in 1674, when he published a small work entitled, "Nouvelle experiences du vide avec la description des machines qui servent a les faire." †

Some of the experiments were made under the direction of Huygens, and the air-pump employed (and which up to that time had also been employed by the *Academie des Sciences*), was devised by Huygens, and was a modified form of Boyle's second air-pump. ‡ The cylinder was 14 inches long by 3 inches diameter, and contained a valve at the bottom opening outwards; a lateral tube communicated with the receiver, and the piston was solid. This air-pump differed in several respects from Boyle's pump; thus the great inconvenience of placing the pump in water to render all the joints air-tight was dispensed with, and the valve was transferred from the piston to the pump barrel, and was self-acting, instead of being worked by hand. This pump is alluded to by Huygens in a "Lettre touchant les phénomenes de l'eau purgée d'air," published in the *Journal des Savans*, for 1672; it must therefore have been constructed soon after the publication of Boyle's second series of "physico-mechanical experiments," in 1669.

The greater number of Papin's "nouvelles experiences" relate to the preservation of edibles (chiefly fruits) in vacuo, and are very void of interest, both on account of their want of novelty, and also because of the tedious and prolix manner in which they are described. We give below one example, which may serve as a specimen of much of Papin's writing:—"Le 27 Juillet, 1673.—J'enfermay 4 framboises et 3 groseilles dans la vuide. Les groseilles paroissent ausse estre tournées, et les framboises sont moins vermeilles qu'elles n'estoient, mais il y a plus de 5 mois que je n'y appercois aucun changement. Je les garderay aussi le plus long-temps que je pourray."

In the last chapter Papin gives an account of a new air-pump which he had devised, and which differed somewhat from those which preceded it. In Boyle's second air pump, and in the modified form of it devised by Huygens, the open end of the pump barrel was placed uppermost, as in the present day. This arrangement was reversed by Papin, who returned to Boyle's original plan of having the open end downwards; but instead of a rack and pinion, Papin connected the piston rod with an iron stirrup, so that the pump stood on the ground and was worked by means of the foot. The air-pump plate was immediately above, and at right angles to the barrel, and the whole pump was about four feet high. The pump was very complex in its construction, and the only notable improvement was in the air-pump plate, which was ground, as also was the receiver, so that the tedious method of cementing the receiver to the pump plate, previously in vogue, was avoided. We also here first find mention of the use of a leather collar with a brass rod passing through it for moving bodies in the receiver during the continuance of the vacuum. To guard further against the leakage of air, a small receptacle, filled with water or treacle, was placed above the leather.

In the "Conservatoire des Arts et Metiers" there is a very old air-pump described simply as "Très ancienne machine pneumatique, a un corps de pompe," of which I have been quite unable to find any account, either in recent works, or in memoirs of the period. It consists of a tripod stand upon which rests a horizontal pump barrel about eight inches long by four inches diameter; the pump plate is immediately above it, and the piston is worked by a handle, which, by means of some unexposed appliance immediately beneath the barrel, gives motion to two sliding rods with a cross piece attached, to which latter the piston rod is connected. In the *Memoires de l'Academie* for 1683, in a paper entitled "Diverses Observations de Physique Générale," it is stated that an air-pump constructed by a M. Delancé had been employed in some determinations of the relative weights of air and water. This may possibly be the pump in question, but no description is given of it.

Shortly after the publication of the "Nouvelle Experiences du Vuide" (viz., in 1675, or the early part of 1676), Papin went to England, and took with him a double-barrelled air-pump, which he had recently invented. Boyle for some time had been unable to carry out any experiments on account of ill-health, and at the time of Papin's arrival he was seeking for an amanuensis. Papin immediately offered his services, at the same time showing him his recently published work, and the double-barrelled air-pump, which there seems to be every reason to believe was constructed in 1675. Papin became Boyle's amanuensis in 1676, and remained for some length of time in his service, during which he conducted a number of experiments at Boyle's suggestion, chiefly with a view of testing the accuracy of previously made experiments: these were published, together with a description of the new air-pump, in 1680, in a work written by Papin,* but read over and revised by Boyle, whose name alone appears on the title-page. It was written in French, and translated into Latin before printing; a translation into English was subsequently published.

It commences with a description of Papin's double-barrelled air-pump, which consisted of two vertical cylinders of brass, in each of which worked a piston fitted with a valve opening upwards; at the bottom of each cylinder there was also a valve opening upwards; indeed the pump was precisely similar to that used in the present day as regards the fitting with self-acting valves, and only differed in the mode of working the pistons. At the top of each piston rod a metal stirrup was fixed, and these were connected by a cord passing over a pulley. The pump was worked by a man who, putting one foot into each of the stirrups, threw the weight of his body first upon one piston and then upon the other; thus the action somewhat resembled that which is practised on a treadmill. The advantages of the double pump barrel over the single barrel are considerable: in all the previous air-pumps the piston had to be drawn from one end of the barrel to the other against the whole pressure of the atmosphere, but by the introduction of two barrels, and the connection of the piston rods, so that the descent of one piston caused the ascent of the other, it will be perceived that the pistons balance each other, for the

* "Histoire de l'Academie Royale des Sciences depuis son établissement en 1666 jusqu' a 1686."—Paris, 1733.

† This work was published in Paris, by Jean Cusson. It is dedicated to Huygens, and contains 28 pages and two plates. Apparently only a small number were printed; it is now very rare.

‡ For an account of which see the 13th of these papers, CHEMICAL NEWS, Vol. 12, p. 62.

* This work is entitled "*A Continuation of New Experiments physico-mechanical, touching the spring and weight of the air, and their effects.*" The second part. By the Hon. Robert Boyle. London, 1680. The first part of the continuation was published in 1669; an account of it will be found in the thirteenth of these papers, CHEMICAL NEWS, Vol. 12, p. 62.

downward pressure of the atmosphere upon one, balances the pressure tending to press down the other. Thus a double-barrelled air-pump not only exhausts in half the time required by a single-barrelled pump, but requires less force to work it.

The degree of rarefaction which obtained in the receiver was measured by a mercury gauge enclosed within the receiver. It consisted of a graduated tube sealed at one end and filled with mercury, with the exception of a small space occupied by a bubble of air, by the expansion of which the degree of rarefaction was ascertained.

The first experiment is dated July 11th, 1676, and relates to "several waies used to help the production of air." The work, for the most part, treats of the preservation of edibles in vacuo and the amount of air produced by various substances when kept for a length of time in closed vessels. There is nothing of interest or utility among the experiments, which much resemble those described in Papin's former treatise.

Among other things, we find an account of Papin's wind-gun and of some experiments made upon animals in compressed air. A mouse was placed in the receiver of the gun, and the air rapidly compressed to one-twentieth of its former volume, the gun was then discharged, the receiver opened, and the mouse was found to be dead, at which Papin expresses great surprise, as he expected to find it "only a little convulsive." A second mouse was then placed in the receiver, and the air compressed to one-fourth its original volume. On discharging the gun and opening the receiver, the mouse was found to be alive and well. Finally, a mouse was left in air compressed to one-seventh of its volume for 24 minutes, and the gun then discharged. When the mouse was taken out it was observed "to fetch many deep groans," and soon after it died, from all of which experiments he deduces the corollary, "That a great compression of air is noxious, yea mortiferous to animals."

In 1684, Papin was appointed curator to the Royal Society with a salary of £30 a year, for which he was to show at least one experiment at each meeting of the society. It will be borne in mind that this office had previously been held by Hooke, now one of the secretaries to the Society.*

(To be continued.)

ON THE

UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.†

As you are aware, the residual products of gas-making are six in number—namely, *coke*, *ammoniacal liquor*, *coal tar*, and the three waste products from the purifiers, as the *spent oxide of iron*, the *refuse lime*, and the *acid or other matters used for absorbing ammonia*, each of which has its special value on account of its technical uses.

I.—Coke.

This need not occupy much of our attention, as its practical value and uses are pretty well known to you. I may say, however, that it was the opinion of the late Dr. Fyfe, and is still the opinion of many chemists who have examined the power of coal under steam-boilers, that the heat actually made available *in practice* is very nearly the same as ought to be produced *according to theory* by the quantity of coke which the coal yields. He found that a pound of Scotch coal from Trenant would boil away 5·61 lbs. of water, and that the coke of it, which amounted to 0·525 of a pound, produced 3·9 lbs. of steam; so that the practical loss was 5·61 − 3·9 = 1·71 lbs.; but the theoretical value of the coke was about 5·5 lbs. of steam. Here is a table of the relative heating power of different fuels, expressed in the number of pounds of water which 1 lb. of the substance will boil away when the water has been heated to its boiling-point :—

Dry wood (average of many specimens)	4·51 lbs.
Derbyshire coal (ditto)	7·58 ,,
Scotch coal (ditto)	7·70 ,,
Lancashire coal (ditto)	7·94 ,,
Newcastle coal (ditto)	8·37 ,,
Welsh coal (ditto)	9·05 ,,
Good coke (ditto)	10·00 ,,

If all these numbers are multiplied by 5·5, they give the quantity of water which a pound of the fuel will in each case raise from 32° to 212°, and the results show that the thermotic power of coke is very high.

II.—Ammoniacal Liquor.

This is the aqueous portion of the condensed products of the gas. It floats upon the tar, and is a watery solution of carbonate, sulphide, and sulphocyanide of ammonium, with certain carbohydrogens of no value.

If all the nitrogen contained in coal were converted into ammonia, so as to make a liquor of 8-oz. strength (4° Twaddle), it would yield from 142 to 226 gallons per ton of coal. This will be evident from the table which is before you, and which represents the average amounts of nitrogen in certain well-known coals in a dry condition :—

	Nitrogen per cent in Coal.	Ammonia per cent from Coal.	Gallons of Liquor of 4° Twaddle p. ton of Coal.
Welsh coal (average) ..	0·91	1·10	142
Lancashire coal (ditto)	1·25	1·52	196
Newcastle coal (ditto)	1·32	1·60	206
Scotch coal (ditto)	1·44	1·75	226

But by far the largest portion of nitrogen is not converted into ammonia, for by combining with sulphur and carbon it forms the sulphocyanides which are so abundant in ammoniacal liquor and in spent lime, and much of it also unites with carbon and hydrogen to produce the alkaloids which exist in the tar. In practice, therefore, you get but a comparatively small proportion of the nitrogen as ammonia in the ammoniacal liquor. The quantity of liquor rarely exceeds 45 gallons of 8-oz strength per ton of coals; and to obtain this quantity you must condense well, and also wash the gas with water. I have already explained to you how this is done at the Birmingham and Staffordshire Gas Works by Mr. Hugh Young, who obtains 44 gallons of liquor per ton of Staveley coal in his yearly working. In ordinary practice the yield is about 25 gallons per ton, and in London it is not above 13 gallons —calculated in every case as 8-oz. liquor. You will see from this how largely the production of ammoniacal liquor may be increased; and I will call to your recollection the valuable advice of your president, Mr. Hawksley, with respect to the copious washing of raw gas with ammoniacal liquor, for this practice has a twofold advantage—it not only purifies the gas by removing tarry matter and sulphur compounds, but it also strengthens the liquor and renders it a more valuable product. By using the liquor as a shower or in a scrubber, in the proportion of 1 volume of liquor to 16 of gas, the liquor may easily be raised to 10° or 11° of Twaddle, which are equivalent to from 20 to 22 ounces of acid; and considering that the price of liquor rises about 4d. or 6d. per butt for every degree of Twaddle, it is manifestly of the greatest importance that the liquor should be sent away from the works as strong as possible. It ought, in fact, never to be under 6° of Twaddle, or of less than 12-oz. strength; and, with proper condensation and judicious washing, there should be from 29 to 30 gallons of such liquor produced from every ton of coals. The average price of ammoniacal liquor of 8-oz. strength, in eleven towns of England, is at the present time 2s. 7d. per butt of 108 gallons. It ranges from 1s. 9d. to 4s. 6d. per butt, and in London it fetches 2s., with an increase of 4d. per butt on every additional ounce of acid strength. Below 3° of Twaddle or 5oz. of acid it does not pay for working, whereas at 10° or 11° of Twaddle it is a valuable

* See the tenth of these papers, CHEM. NEWS, vol ii.. p. 38.

† A lecture delivered before the British Association ofGas Managers. Corrected and communicated to this paper by the Author.

product. The strength of the liquor may be estimated either by the hydrometer or by the quantity of strong sulphuric acid (sp. gr. ·1845) required to neutralise it; and it will be found that every degree of Twaddle is equal to about 2 ounces of acid per gallon of liquor.

The method of converting the liquid into a salt of ammonia varies in different places according to the facilities for working. In some places the liquor is at once saturated either with sulphuric or muriatic acid, in a close tank, and the evolved gases (sulphuretted hydrogen and carbonic acid) are carried to a furnace or to a furnace shaft. The saturated liquor is then evaporated and crystallised in open troughs. This, however, produces a dark-coloured salt which is not very saleable. The liquor, therefore, is either distilled alone from a steam-boiler, or it is mixed with lime in the boiler, so as to fix the sulphuretted hydrogen and carbonic acid, and is then distilled. In many works the liquor is heated in an apparatus called a Coffey's still, which is a tall vessel containing a number of transverse divisions (from 20 to 30) which alternately pass to nearly the opposite sides of the vessel. The liquor is run in at the top, and as it flows from side to side over the alternate divisions, in its way downwards it meets a rush of steam, which is admitted at the bottom of the vessel, at a pressure of from 20 to 30 lbs. upon the inch, and thus the carbonate and sulphide of ammonium are volatilized. In all these cases the ammonia is distilled into a close vessel containing sulphuric acid, diluted with enough water to prevent the salt from crystallising (equal parts of brown chamber acid of commerce and water are good proportions); and the evolved gas (carbonic acid and sulphuretted hydrogen) is conveyed to the furnace fire, or is used for the production of oil of vitriol. When the ammoniacal liquid is evaporated by blowing steam into it, it is necessary to have a worm, or other cooling apparatus, to condense the water from the gases before they are carried to the furnace, or they will perhaps extinguish the fire. While the distillation is going on the acid in the saturating vessel is frequently examined, and when it is thoroughly neutralized, it is run out into a proper receiver, and is then transferred to shallow pans or troughs, where it is evaporated to the crystallizing point.

The residual liquor from the stills is not completely exhausted of ammonia, but contains from 3 to 5 ounces of sulphocyanide of ammonium per gallon. It is, therefore, treated with lime, and again distilled, whereby more ammonia is obtained.

If there were a large demand for the sulphocyanide, it might perhaps be worth while to recover it from the spent liquor by evaporation, especially where it could be done by waste heat. Here is some of the residual liquor, and you will notice that when I add to it a very acid solution of a persalt of iron it produces a deep blood-red colour of the ferric-sulphocyanide. Here also is some of the salt obtained from the liquor by evaporation, and it is well suited for the preparation of this white powder, the mercuric sulphocyanide, which is the sole constituent of the little toys called Pharaoh's serpents. Sulphocyanide of ammonium is also used to some extent by photographers. I may here mention that the watery solution which runs from the hydraulic mains with the tar, when the temperature is not below 150° Fahr., contains this salt, without any carbonate or sulphide of ammonium; there is no reason, therefore, why this solution may not be collected, apart from the true ammoniacal liquor which is found in the condensers, for even if it be not of much value on its own account, it might be kept from diluting the liquor in the first stages of condensation, and be afterwards used instead of water for finally washing the raw gas.

In country gas-works, where there is no little or no sale for ammoniacal liquor, it would not be difficult to convert it into sulphate of ammonia, by transferring it to an old boiler, then blowing steam into it, and carrying the vapours into a properly constructed vessel, charged with the brown sulphuric acid of commerce, diluted with the mother liquor of a previous crystallisation. In this way every ton of coals should yield about 30 lbs. of sulphate of ammonia.

This sulphate is worth from £12 to £14 per ton, and it is not merely used for agricultural purposes, but it is the salt from which all other preparations of ammonia are obtained. Distilled with quick lime it yields pure ammonia, which by condensation in water forms the liquor ammoniæ of commerce; distilled with chalk it makes carbonate of ammonia; and it has other applications. There are good reasons, therefore, why great pains should be taken to recover all the ammonia of gas-making. We shall presently see how this may be further accomplished by means of absorbent agents placed at the end of the purifiers.

REPORTS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

ON THE ABSORPTION OF GASES BY METALS.

By Dr. Odling, F.R.S., &c.

In a Friday evening lecture which which I had the honour of delivering here before Easter, I drew your attention to a very singular property possessed by the metal platinum, some very beautiful specimens of which are exhibited in the library, through the kindness of Messrs. Johnson and Matthey, to whom I am also indebted for the greater portion of the articles upon the table. Now platinum, especially that which has been solidified after fusion, appears, at any rate, to be a perfectly homogeneous metal. It does not show the slightest evidence of porosity, and is absolutely impermeable to the passage of gas through it. For instance, if we take a wide platinum tube, drawn out from a single piece of fused platinum, and seal one end by soldering on to it a piece of platinum foil, and similarly close the other end with another piece of foil having a small central orifice, through which a narrow attachment tube projects, we shall have a hollow cylinder of platinum, from which, by connection with the barrel of an ordinary air-pump, or with an air-pump of Sprengel's construction, the air can be exhausted as readily and completely as from a glass tube. That is to say, as perfect a vacuum can be produced and sustained within a tube of platinum as within a tube of glass. Not a particle of air passes bodily from the external atmosphere through the substance of the metal into the internal vacuous space by means of atmospheric pressure, and, what is more to the purpose, not a particle of air passes molecularly through the metal by means of the far more refined and accusing process of diffusion; and this is true, not only of atmospheric air, but of every gas with which the experiment has been made, and is doubtless true of all gases whatsoever. But if, instead of making such an experiment with the platinum tube at ordinary temperature, we make it with the tube at a red heat, under this condition the metal still remains perfectly impervious to the passage of atmospheric air, and of all other gases—except one. One gas alone, under those circumstances, is found to penetrate the platinum, even with very considerable facility, and that gas is hydrogen. The fact that hydrogen has this distinctive property of penetrating ignited platinum, first observed by M. Deville, of Paris, evidently shows that there is something peculiar, something altogether special, in the relation subsisting between the gas and the metal, to which the effect is due. The mode in which the experiment has been recently made is of this kind:—The platinum tube is first attached to an air-pump of Dr. Sprengel's construction, which acts on the principle of the trompe. We have mercury constantly dropping from a constricted funnel down a long narrow glass

tube; and as each drop of falling mercury is sufficient to fill the tube, each such drop acts as a small piston which pushes down a column of air before it, and by pushing down successive portions of air eventually effects a complete exhaustion of any vessel communicating with the fall tube. Indeed, by an instrument of this kind, as perfect a vacuum can be obtained as in the Torricellian vacuum itself, and by its employment a vacuum is easily obtained in the interior of our platinum tube. Before being exhausted, the platinum tube is placed within a tube of porcelain; while in the space between the two tubes a current of hydrogen is continually passed. The internal platinum tube being rendered vacuous, the external porcelain tube is heated in any form of furnace, —in a gas furnace, for instance, as shown here, or in a charcoal furnace; and so soon as the external porcelain tube acquires a bright red heat,—so soon in fact, as the interior platinum tube becomes red hot,—and not till then, do we find that as each drop of mercury falls through the tube of the pump, it carries before it a certain quantity of air or gas which it delivers into this small inverted test-tube of mercury placed for its reception. So soon, therefore, as the platinum tube becomes red hot, a portion of the hydrogen gas confined in the intermediate annular space between the porcelain and the platinum tubes, enters the platinum tube, is exhausted from its interior by means of the Sprengel pump, and is delivered into the test-tube for examination.

There is another metal, namely palladium, one of the platinum group of metals, and closely related to platinum, through which the transmission of hydrogen is yet more easily exhibited, since a temperature very far short of redness is sufficient to render this metal pervious to the gas.

Here is an ordinary apparatus for generating hydrogen. The gas passes through sulphuric acid to dry it, and then through the glass tube in which the palladium tube is contained. You see it from time to time take fire, though it does not burn continuously in consequence of its being delivered through the sulphuric acid in the form of bubbles. The small tube of palladium, contained within the glass tube, is made exactly like our platinum tube, except that it is much shorter. At the present time it is vacuous, having been exhausted by means of the Sprengel pump before the lecture. If you will direct your attention to the small inverted test tube of mercury, you will see that at the present time there is no gas being delivered into it, but we will now heat the palladium tube gently through the glass tube, and long before it gets to a red heat you will find that some of the hydrogen gas which is passing outside the vacuous palladium tube will penetrate through the thickness of the metal into the interior of the tube, be sucked from its interior by means of the Sprengel pump, and delivered into the test tube. I have no doubt that after a few moments, you will see that a quantity of gas will be delivered into the test tube in this way, which gas we shall see to be hydrogen sucked from the interior of the tube of palladium, through the substance of which it has been transmitted. At the present moment, if you listen, you will hear each drop of mercury falling just as it falls in a barometer; but in a few minutes—and I must beg your patience for this experiment, because it will take some little time—we shall lose this clicking sound, through the entrance of gas into the full tube; of which gas, after a little while, we shall get an appreciable volume delivered. A few bubbles of gas have already come over. Those who are near can see that a quantity of gas is being gradually collected in the inverted test tube, which will soon amount to several cubic centimètres. On now putting a light to it, you see that it takes fire and burns in the characteristic manner of hydrogen. Within a few minutes, then, hydrogen, to the amount of several cubic centimètres, has passed from the exterior of the moderately heated palladium tube, through the substance of the tube, into its previously vacuous interior, whence it has been sucked out and delivered by the Sprengel pump.

A curious point of interest is that, in the case of heated palladium, as in the case of ignited platinum, hydrogen is the only gas which passes through the metal. If we take a mixture of hydrogen gas with some other gas, the hydrogen only is sucked through the platinum or palladium, the other gases remaining untransmitted. From the complex mixture of gases, for instance, which constitute ordinary coal gas, hydrogen may be separated in a perfectly pure state by its passage through heated platinum or palladium, which are impervious to all the other coal-gas constituents, as I had the honour of showing you in my former lecture.

Now what is the nature of this transmission of hydrogen through solid metal? On the last occasion, I had an opportunity of demonstrating to you that the phenomenon had no relation to those physical actions which are denominated transpiration and diffusion, but that it was an action of an entirely peculiar character, and was probably preceded by an absorption of the hydrogen in the substance of the metal; and this absorption of hydrogen by platinum, and of other gases by other metals, forms the subject of my present lecture. I wish to show you that in these cases the passage or transmission of the hydrogen gas, through the platinum, or the palladium is preceded by an absorption of the hydrogen gas in the substance of the platinum or the palladium.

The experiment is made in this way: in the first instance some platinum wire is introduced into a porcelain tube of this description, which is closed at one end, and at the other end connected with a Sprengel-pump. The tube is then heated, and its interior rendered vacuous. After the establishment of a vacuum, hydrogen gas is passed over the red hot platinum wire contained in the tube, and the platinum gradually and slowly allowed to cool with the hydrogen gas still passing over it, so that if the platinum has any power of absorbing hydrogen gas it shall have every chance of doing so, and shall, so to speak, select its own absorbing temperature, from the temperature of a red heat down to that of the atmosphere. The platinum was then removed and exposed freely to the air, so that any accidental hydrogen adhering to the surface might be removed. It was then introduced into another tube of this kind, which in this particular case is made of glass in order that it may be seen through, but which, in the actual experiment, was made of porcelain. This tube, containing the charged platinum wire, was attached to the Sprengel-pump, and again perfectly exhausted,—the air removed from it by the exhauster being found absolutely free from hydrogen. Then heat was applied, and, at the moment when the tube became red hot a delivery of hydrogen gas began to take place, and continued for some time, showing that the platinum had absorbed a certain quantity of hydrogen gas, which it delivered up at a red heat under the influence of the vacuum. In the first experiment, then, from fused platinum exposed in this manner to the action of hydrogen at a red heat and gradually decreasing temperature, there was afterwards extracted as much as 21 per cent of hydrogen.

Now what was the nature of this behaviour of platinum towards hydrogen? Did it depend upon surface action? If so it would be increased by an increase of the surface of the platinum. The wire was accordingly drawn out to four times its length, which would give rather less than four times the former surface; but in this case only 17 per cent of hydrogen was extracted after treating the wire as in the previous experiment. Quadrupling the surface, therefore, did not increase the quantity of gas absorbed, and it was found on a repetition of these experiments that the quantity of gas absorbed gradually got less and less. In a third experiment with the same wire, the quantity absorbed amounted to only 13 per cent.

Now comes the question, if this power of the metal to absorb hydrogen is not a question of surface, is it a question of texture? Accordingly, spongy platinum was employed, and in that case it was found that the metal absorbed 148 per cent of gas, that is, about 1½ times its

volume of hydrogen gas, measured at the temperature of the atmosphere. As fused platinum we had the metal in its densest, or rather in its most compact form. As platinum sponge we had it in its most porous form; while as ordinary wrought platinum we have it in a sort of intermediate form—not so porous as the one, and not so compact as the other. What, then, was the result obtained with the wrought platinum? Well, it was found that one volume of wrought platinum absorbed 4·8 times its volume of hydrogen, or 480 per cent. This is the mean of three experiments made with the same portion of platinum. One of them gave 5·5; another gave about 4·9; and the other gave 3·8 volumes of gas. The next experiment was made with a different portion of platinum; and in this case, although the metal contained 3¾ times its volume of hydrogen gas (379 per cent.), measured cold, it was found that none of this gas could be evolved into a vacuum except at a red heat. At first the platinum was submitted to a temperature of 240°, but not a particle of gas was given off. The metal was then heated by a small Bunsen burner to a temperature just short of redness for an hour, and still no gas was given off; not, indeed, until the temperature arrived at the point of redness, could any gas whatever be extracted.

We are all of us familiar with the effects of atmospheric pressure, and know that a variety of experiments have been devised by which the results of this pressure may be manifested. One of these is the common experiment of bursting a bladder stretched over a short glass cylinder exhausted by the air pump. [This experiment was performed, a sharp report accompanying the breaking of the membrane.] Now, let us compare the force exerted by atmospheric pressure in this way, with the force exerted by platinum in condensing hydrogen gas. Let us consider the experiments of which the mean result was 4·8. As I have said, one of these experiments gave 5·5; and for the sake of taking round numbers we will say that 5 volumes of gas were absorbed by one volume of platinum. Taking a cubic centimètre of platinum, then, it absorbs five times its bulk of gas. To condense these 5 centimètres of gas into the space of one cubic centimètre, would require the pressure of five atmospheres; or five times the force just exerted by the air in bursting that bladder. But at the temperature at which the experiment was made, these five centimètres were really 15; and accordingly, we have to consider the compression of 15 cubic centimètres of hydrogen into one cubic centimètre, for which purpose we should require 15 times the atmospheric pressure which was just employed. But in reality, this does not represent anything like what has been done. We have not merely compressed these 15 volumes of gas into 1 cubic centimètre of space, but we have compressed them into so much of 1 cubic centimètre of space as appears to be fully occupied by platinum, but is not really so occupied. If we assume, for instance, that in this cubic centimètre, which appears to be all platinum, there is, say, one thousandth part of it which is not platinum, to compress our 15 cubic centimètres of hydrogen into this space would require a pressure of 15,000 atmospheres. So that when this piece of platinum absorbs 15 times its bulk of hydrogen gas at a red heat, it exerts some 15,000 times the compressing force that was exerted by the atmosphere in bursting that bladder.

My time is passing away so rapidly that I fear I shall have to omit a good many points of interest; but I may direct your attention to the fact that, although the evolution of hydrogen by platinum takes place only at a red heat,—and indeed some charged platinum that had been preserved for two months was found still to retain the whole of its hydrogen—yet the absorption of the gas by the metal takes place at a much lower temperature. Thus at 230°, platinum absorbed 1¼ times its volume, or 145 per cent, and even at a temperature below 100°, the boiling point of water, it absorbed 76 per cent of gas.

When, however, we come to speak of palladium, the facts are far more striking even than with platinum,—palladium appearing to be a metal altogether special in its relations to hydrogen, which it absorbs abundantly even at a comparatively low temperature. A piece of wrought palladium foil heated to 245°, was found to absorb 526 times its volume of hydrogen, the gas being measured at the ordinary temperature; but it was found that even the temperature of 245° exceeded the most suitable point, and that at the temperature of 100° the metal absorbed 643 times its volume of the gas. Now, if it is a difficult thing to conceive how 15 cubic centimètres of hydrogen should be compressed into the interspace existing in a cubic centimetre of platinum, still more difficult is it to conceive how 6 mètres of centimètres of hydrogen should in the same way be compressed, not into one cubic centimètre of space, but into so much of what seems to be a cubic centimètre of palladium as is not really occupied by the palladium. At a temperature falling short of 20°, that is without the limits of ordinary atmospheric temperature, the palladium still absorbed 376 volumes of gas.

In the case of spongy palladium, of which I have here a specimen, there was not such a difference between it and the wrought palladium, as there was between the spongy platinum and the wrought platinum. It was found that the spongy palladium absorbed 680 times its volume of gas, while the wrought palladium absorbed 643 times.

Here is some wrought palladium foil which has been charged in the manner I have described, and now contains some six or seven hundred times its volume of hydrogen locked up or occluded in it. This hydrogen does not come off appreciably, or only in very small proportion, until the metal is heated, but on the application of heat, we shall be able to collect the gas with facility. The piece of foil has been charged with hydrogen gas at a temperature of 200°, then exposed freely to the air, and afterwards introduced into the tube. The tube is then exhausted, and now we are beginning to heat it. On the application of heat, the hydrogen gas will be given off and delivered in the test tube as in the former experiment, the only difference being that in the former experiment we sucked the hydrogen through the tube, and in this case we are extracting the hydrogen which has been absorbed by the metal. It will take some little time for us to collect any considerable quantity, but you see already that the hydrogen gas which was absorbed by the palladium, is now being given off by it. Mr. Roberts, to whose zeal Mr. Graham and myself are both much indebted, has now got the hydrogen in the test tube, and on my applying a light, you perceive the combustion of the hydrogen gas, which we have just extracted from the charged palladium.

The hydrogen gas condensed in this way in the substance of the palladium is capable of exerting certain chemical actions which hydrogen gas in its ordinary state is not. We find that this condensed hydrogen acts as nascent hydrogen, exhibiting all those reducing actions which are characteristic of nascent hydrogen. To give you an illustration of some of these chemical actions of the condensed hydrogen, we have here a solution of permanganate of potassium, into which we will introduce a portion of the palladium charged with hydrogen. The action will not be immediate, but after a little while you will see that the permanganate will become decolorised by the action of the hydrogen which has been absorbed into the palladium. Here we have some solution of the ferricyanide of iron, and on putting into it a portion of the charged palladium, we shall have a gradual development of Prussian blue. The difficulty of the experiment is that the palladium, being heavy, sinks, and does not come much into contact with the liquid; but even now you see that a certain amount of blue tinge has been imparted. You also see that in the other vessel which contains the permanganate a certain amount of bleaching action has taken place. Hydrogen, in this form, will also bleach the iodide of starch. If we introduce into that compound some of this hydrogenetted palladium, hydriodic acid will be formed, and the blue colour of the iodide of starch disappear, though the action will require some little time. In the case of the ferri-

cyanide of iron solution a very decided blueing has now taken place, which will increase to a yet more obvious extent. The permanganate is already almost bleached by the reducing action of the hydrogen absorbed into the palladium, while the colour of the iodide of starch is gradually disappearing. By these results, you see that hydrogen is capable, when thus absorbed, of producing those characteristeric chemical effects which, under ordinary circumstances, are only observed of so-called "nascent hydrogen."

There are a great number of other interesting points connected with the absorption of gases by these two metals, palladium and platinum; but my time is getting on so rapidly that I must proceed if you please to consider the absorptions manifested by some other metals. In the case of copper it is found that this metal, in the form of wire, will absorb 30 per cent of hydrogen, whereas in the spongy form it will absorb 60 per cent. Gold is unlike platinum in this particular—that it will absorb a great number of different gases, whereas platinum absorbs hydrogen only. Gold, in the form of assay cornettes, was found to absorb 48 per cent of hydrogen, 29 per cent of carbonic oxide, 16 per cent of carbonic acid, and 20 per cent of air, but, of this air, absorbed by the gold, nearly the whole was nitrogen. Whereas ordinary atmospheric air contains 21 per cent of oxygen, the air absorbed by gold contained only 5·3 per cent of oxygen. Gold, therefore, seems to be a metal which is singularly indifferent to oxygen. Before charging the cornettes with carbonic acid or carbonic oxide it was necessary to ascertain that they did not contain any gas in the first instance. But it was found that they really did contain a considerable proportion of what may be called natural gas, which had to be removed from them. This gas amounted to 212 per cent. The gold cornettes actually contained twice their volume of natural gas, which consisted chiefly of hydrogen and carbonic oxide, with the exact proportions of which I will not trouble you, and which had been absorbed from the muffle furnace in which the cornettes had been originally heated.

(To be continued.)

ACADEMY OF SCIENCES.

JULY 15, 1867.

(FROM OUR OWN CORRESPONDENT.)

Pre-Newtonian ideas of gravitation.—Marine Engines.—Election of M. Wurtz as a member of the Academy.—Perfluoride of Manganese.—Isolation of fluorine.—Oxychloride of Magnesia to replace Plaster of Paris.

M. CHASLES laid on the table the letters and notes from Pascal alluded to at the last meeting. It is incontestable that in these autographs, the date of which is certainly anterior to 1562, the year of the death of Pascal, the illustrious philosopher speaks of attraction at a distance as well as at the surface of the earth and in the midst of the celestial spaces, and even of molecular attraction, in the same terms as Newton. He makes the same calculation of bodies falling in an orbit, of mass, of distance; he lays down the same laws, &c.

M. Du Puy de Lome made a long and interesting communication on the marine engines of the ship of war Friedland, of the French navy, with three cylinders and of 1000 nominal horse-power, and an effective power of 4000, which will give the ship a speed of fourteen knots an hour with sixty revolutions of the screw per minute.

The academy then proceeded to the election of a member in place of M. Pelouse. The number voting was 53; M. Wurtz was elected with 45 votes against 3 given to M. Berthelot, and 2 to M. Cahours. It is, as we have before stated, almost the unanimity of votes; there were two blank billets, that is to say, that two of the illustrious did not consider MM. Wurtz, Berthelot, and Cahours worthy of sitting beside them, and did not give themselves the trouble of choosing between them. It is melancholy to see academicians imbued with feelings of such a foolish disdain, or evincing publicly so great a meanness of spirit.

M. Dumas announced that M. Nicklès, of Nancy, had just made a discovery in mineral chemistry by showing how to prepare a combination of fluorine and manganese, which is to the simple fluoride what the binoxide or sesquioxide is to the simple oxide, the protochloride, and the protoidide to the deuto, sesqui, or polychloride, or iodide. M. Nicklés has found that the new combination, deutofluoride, or fluoride of fluoride of manganese, is less stable than the analogous chloride or iodide. Moreover, and this gives great importance to the discovery, the deuto-fluoride will certainly be less stable than the simple fluoride of manganese, and it seems difficult to believe that we shall not one day succeed in decomposing it by heat, or otherwise, into fluorine and fluoride of manganese, under conditions which will permit the fluorine to be isolated, and so fill up a great gap in chemistry.

M. Dumas then called the attention of the academy to a new industry of M. Sarel, which nothing could lead us to foresee, viz., that chloride of magnesium can unite and associate with magnesia or oxide of magnesium to form an oxychloride of magnesium perfectly insoluble and possessing, as does the oxychloride of zinc, in a degree incomparably greater than plaster of Paris, the property of not only taking all variety of forms, but of causing the solidification and taking a high polish of a great number of substances with which it may be mixed, in the proportion of a fifteenth to a twentieth of their weight. Experiments made two years ago leave no doubt on the good quality of stones prepared by this process, and the absolute resistance, of objects so fabricated and moulded, to the deleterious action of water. Industry and art will therefore enter into possession of new elements of construction and transformation. The chloride of magnesium that can be extracted from sea water, or which is found in great quantities solidified in interior seas as that of Stassfurth, does not require to be entirely pure, and costs less than the oxychloride of zinc.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

Manufacture of starch, utilisation of the waste.—Phenic acid its manufacture and properties.

PARIS, JULY 17, 1867.

MORE than 100 tons of wheat are annually employed in the fabrication of starch in France. M. L. Maiche, of Paris, now proposes to utilise the waste as an aliment.

The best wheat only contains 55 per cent of starch, while rice of the most ordinary description contains 85 per cent; maize and buck-wheat also contain a considerable proportion. The difficulty consists in the separation of foreign matters, such as bran, cellulose, gluten, &c., contained in the pulp of the grains. Having isolated small quantities of cellular tissue and other substances, the author found that the specific gravity of these bodies was much less than that of starch.

If raw starch is placed in water, a small quantity of almost pure starch is deposited, but the bulk only falls mixed with the different substances above mentioned; these, although specifically lighter, are relatively more heavy, being much larger than the starch grains. M. Maiche takes advantage of difference of specific gravity, in order to obtain a complete separation; he makes use of centrifugal force, by which the specifically heavier bodies are thrown farthest off. The mode of operation is the following:—A mixture of raw starch and two parts of water is introduced into a sort of drum of copper, turning on its axis at the rate of 1,000 to 1,200 revolutions per minute; as soon as the velocity attains 450 turns, the starch commences to be separated, and collects in a compact mass, adhering to the sides of the vessel; all the

impurities remain in the water, in the centre, which is easily drawn off, while the perfectly white and pure starch can be removed in lumps. All amylaceous matters can be treated by this method, and the extraction of the starch which formerly required several weeks, now takes place in a few minutes. The return is much greater, for 100 kilogs. of rice, costing less than 100 kilogs. of wheat, give more than 20 francs worth of starch. There is then no reason for employing, in the manufacture of starch, wheat which gives the best and most nutritious flour, and the chief principle of nutrition of which, the gluten, is almost entirely lost by the process actually employed.

We give an extract from the excellent lecture given at the Society of Encouragement for National Industry, on *Phenic Acid and its Compounds*, by Dr. Crace-Calvert. It is well known that when coal is heated to a low degree in retorts or distillatory apparatus it gives off substances that can be classed into four groups.

1. Gaseous products furnishing light, heat, and motive power.

2. Water containing ammoniacal salts, which can be purified by well-known chemical means, and utilised in agriculture and in the industrial and medical arts.

3. A thick, black, sticky mass of a repulsive odour, to which the name of *tar* has been given, and which passes over along with the above-named products.

4. A solid porous body, known by everybody as "coke," which remains in the retorts.

When tar is submitted to distillation, first water is obtained, then products which pass over with this liquid, but which, lighter than it, float on the surface, and are therefore termed the *light coal oils*. Lastly, there is distilled a compound heavier than water, and consequently called *heavy oil*.

It was about the year 1837 that these heavy oils were first used for the preservation of sleepers according to Bethell's process. M. Farestier, engineer-in-chief of the department of the Vendée, conjointly with M. Marin, engineer, published a very remarkable and very complete work on the creosoting of wood and its preservation for twelve, fifteen, or twenty years from decay and the ravages of water and the teredo. There remains in the retort a substance fusible at the high temperature attained after the oils have passed over. This is asphalte or bitumen, which hardens on cooling. The distinguished lecturer then proceeded to "phenic acid," stating that M. Laurent, the great French chemist, was the first to indicate the method of extracting phenic acid from tar. It consisted in submitting the light coal oils to a partial distillation, and treating by a concentrated solution of potash, the products distilling at a temperature between 160° and 200° C.

In 1847 Mr. Mansfield indicated another method of treating the heavy oils by caustic alkalies, and towards 1856 M. Bobœuf made known his modified process of M. Laurent. This consists chiefly in the use of caustic soda instead of potash, and treating the whole of the light oils, instead of a portion, by Laurent's method; but this only gave an impure acid, yet, in a commercial point of view, it was a progress. Of a similar nature were the products manufactured by Mr. John Bethell, since 1847, under the direction of Mr. Calvert. They were used for several purposes, either for the production of picric acid, or for transforming tannic acid into gallic acid, or for preserving organic substances from putrefaction. M. Bobœuf used it also very extensively for this purpose.

In 1859, M. Marmas, of the firm of Guinon, Marmas, and Bonnet, of Lyons, came to Manchester, and requested Mr. Calvert to furnish a purer picric acid than that hitherto made, showing him, at the same time, a product white and crystalline, which they furnished as a type. Mr. Calvert made new researches, and discovered that the most favourable mode of preparation was not to treat the coal oils with concentrated alkalies; but, on the contrary, to treat impure benzine of commerce, or naphtha, by weak alkaline solutions.

By this means, a blackish semi-fluid product was obtained, a little heavier than water, having a sp. gr. of 1·06, containing 50 per cent of real phenic acid, and which acid he separated partly by the aid of distillation. After further researches, Mr. Calvert produced white phenic acid in detached crystals, melting between 26° and 27°C. Towards the end of last year he discovered a process by which he produces phenic acid free from all unpleasant taste; and what deserves remark is, that it is as pure, though it is made from coal tar, as if it had been artificially produced by the aid of reactions recently discovered by MM. Wurtz and Kékulé.

F. Moigno.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Succinic Acid, constitution of.—H. Wichelhaus. (C = 12, O = 16). While succinic acid, in accordance with its formation from bicyanethylene, has generally been viewed as bicarbethylenic acid,

$$\begin{array}{l} CH_2.CO.OH \\ | \\ CH_2.CO.OH \end{array}$$

it has been represented recently by Claus (*Ann. Ch. Pharm.* cxli., 49) as bicarbethylidenic acid,

$$\begin{array}{l} CH_3 \\ | \\ CH(CO.OH)_2 \end{array}$$

As a necessary support to the latter view, the acid derived by H. Müller from cyanpropionic acid (which was prepared from chlorpropionic ethide) should have been identical with succinic acid. This, however, is not the case; they differ in melting point, solubility, and in their behaviour towards ferric chloride. On the other hand, an acid has been obtained from β chlorpropionic acid (derived from glyceric acid) by the same reaction, that is, treatment with potassic cyanide and decomposition with potassic hydrate, which has the same properties as succinic acid. It would appear, therefore, that β chlorpropionic acid is the starting point for the synthesis of succinic acid, and that the latter must still be considered as bicarbethylenic acid.—(*Zeitschr. Chem.*, N.F. iii., 247).

Tannic Acids.—H. Hlasiwetz (C = 12, O = 16). Caffetannic acid, when treated with potassic hydrate, is successively converted into caffeic acid, sugar, and protocatechuic acid. Caffeic acid

$$C_9H_8O_4\ \tfrac{1}{2}H_2O$$

is obtained by boiling caffetannic acid with a solution of potassic hydrate of 1.25. sp. gr. ½ of an hour. It is then precipitated with sulphuric acid, recrystallised from water, and decolorised with animal charcoal. It is soluble in alcohol; ferric chloride produces in its aqueous solution a green colour, which turns dark red on addition of soda; it is precipitated by plumbic acetate, and converted into oxalic acid by nitric acid. Fused with potassic hydrate, it breaks up into protocatechuic and acetic acid, and dry distillation converts it into pyrocatechin. Treated with sodium amalgam it takes up 2H forming hydrocaffeic acid. Caffeic acid is triatomic, and is the third in the following series:

Cinnamic acid .. $= C_9H_7O.OH$
Coumaric acid .. $= C_9H_6O_2OH$
Caffeic acid .... $= C_9H_5O_3OH$

which, on being treated with fusing potassic hydrate, are converted, with formation of acetic acid, into the series:

Benzoic acid .. .. $= C_7H_5O.OH$
Salycylic acid .. $= C_7H_4O.2OH$
Protocatechuic acid $= C_7H_3O.3OH$

The solution from which the caffeic acid has crystallised contains sugar; it is neutralised with potassic hydrate, evaporated and extracted with alcohol. After purification the sugar appears as a syrupy, non-crystallisable mass, showing the usual reactions. An analysis gave the formula, $C_6H_{10}O_4$.

Caffetannic acid, by its splitting up into caffeic acid and sugar is thus proved to be a glucosid.—(*Akad. Wien.* lv. 1867).

Ammoniacal Platinum Compounds.—T. F. Cleve has given an account of his researches on the platinum-bases, comprising a critical examination of those already known, and a description of many new derivatives of these interesting compounds. For detail, we must refer to the original paper.—(*Bull. Soc. Chim.* vii. 12; or, more complete, *Acta Societ. Scient. d'Uphala*, 1866).

Tea, constituents of.—H. Hlasiwetz and Malin. (C=12, O=16). Rochleder states that tannic acid and boheic acid may be obtained from a decoction of tea by precipitation, first with neutral plumbic acetate, and the filtrate therefrom with basic or ammoniacal plumbic acetate. The authors, however, find that both precipitates alike contain tannic, gallic, and oxalic acid; the latter, besides, a small quantity of quercetin,

$$C_{27}H_{18}O_{12},$$

which imparts to it a yellow colour. If the lead precipitate is decomposed with sulphuretted hydrogen, and the filtrate boiled with dilute sulphuric acid, much more of this body is obtained; from which it appears that the original solution does not contain quercetin in the free state, but probably as quercitrin.—(*Akad. Wien.* lv., 1867).

Aromatic Aldehydes under the Influence of Dehydrating agents. — V. Longuinine. (C=12, O=16.) Cuminol ($C_{10}H_{12}O$,) is powerfully acted upon by phosphoric anhydride, being converted by it into a resinous mass. Zincic chloride is without action in the cold, and almost so at the temperature of the water-bath, but if employed in the fused state, a violent reaction takes place, which results in the formation of Cymol (C_{12},H_{14}). The author believes that first the hydrocarbon $C_{10}H_{10}$ is formed, which subsequently combines with hydrogen, resulting from the complete decomposition of a portion of the aldehyde.—(*Comptes*, R. lxiv. 785.)

Argentic Iodide.—H. Fizeau finds that amorphous argentic iodide (prepared by precipitation), like the crystallised and fused modification (CHEMICAL NEWS, No. 386), shows the remarkable phenomenon of contraction with rising, and expansion with falling temperature.—*Comptes*, R. lxiv. 772.)

Iodine-Starch.—H. Pellet. From experiments made as to the cause of the decolorisation of iodine-starch on heating, and reappearance of the colour on cooling, the author arrives at the following conclusions:—1. Decolorisation is caused by the solution of iodine-starch in an excess of hot starch; the solubility being less in the cold, the colour reappears again on cooling. 2. Iodine-starch is decomposed at 100°C, and iodine volatilises. 3. Iodine-starch remains unchanged in alcohol, being equally insoluble in that liquor whether hot or cold. 4. Iodine-starch may be regarded as a salt, which in certain solvents is more readily soluble when hot, than when they are cold.—(*Bull. Soc. Chim.* vii. 147.)

Ozonometry.—A. Cossa is engaged with experiments, the object of which is to discover an exact method for the determination of ozone in atmospheric air. The author has at present established the following facts:—1. A solution of pure potassic hydrate (free from every trace of organic matter) absorbs nitro-oxygen-compounds without destroying ozone. 2. The quantity of iodine liberated in a solution of pure potassic iodide is in exact proportion to the amount of ozone that has passed through the liquid, and may be accurately measured by means of Bunsen's volumetric liquid.—(*Zeit. Analyt. Ch.* vi. 24.)

Quinine, Testing of.—Stoddart recommends the following methods for testing quinine for quinidine, &c.:—6 grammes of the suspected quinine are dissolved in a test tube in 5 grammes sulphuric acid, diluted with 3 grammes water; to this is added 7·5 grammes ether, 18 grammes alcohol, and 2 grammes of a solution of sodic hydrate containing about 8 per cent. The mixture is well shaken, and left to itself for 12 hours. If quinidine, cinchonine, or cinchonidine are present, they will be found in a layer below the ether—quinidine as an oily liquid, cinchonidine in crystals.

The second method consists of a microscopic examination of the crystalline precipitate produced in a saturated and neutral solution of quininic sulphate by potassic sulphocyanide. (10gr. in 45gr. water.)—(*Journ. Pharm. Chim.* iv. 50.)

Ferric Chloride, Volatility of.—R. Fresenius. The author has made a few experiments in order to decide whether any loss is likely to occur in analytical operations through iron being volatilised during evaporation of its solution with an excess of chlorhydric acid. In one experiment he evaporated ferric chloride with chlorhydric acid nearly to dryness; in a second, the evaporation was performed in presence of an alkaline chloride, and the mass afterwards kept on the water-bath for twelve hours; in a third, ferric chloride, with much chlorhydric acid, was kept boiling for 1½ hours. In neither case did any loss of iron take place.—(*Zeitschr. Analyt. Chem.* vi. 92.)

CORRESPONDENCE.

MAGNETISM AND GRAVITATION.

To the Editor of the Chemical News.

SIR,—The paper by Mr. Newlands appears to me to be based in great part, if not entirely, on erroneous notions regarding magnetism.

If the distance between the pole of a magnet and a magnetic body is very considerable as compared to the size of the latter, the body will not be attracted, inasmuch as two opposite poles are always produced by induction; and as, under the above conditions, both these induced poles may be regarded as at the same distance from the inducing pole, the one will be repelled exactly as strongly as the other is attracted, the result, as regards attraction, will therefore be *nil*. The distance of the poles of the earth being almost infinite compared to the size of a piece of iron on the pan of our balance, the iron will not be attracted by the magnetic power of the earth, and will weigh as much on the equator as on the poles, subject only to the altered force of gravity.—I am, &c.,

A. D.

VAPOUR DENSITY OF WATER.

To the Editor of the Chemical News.

SIR,—The apparent discrepancy between the two modes of calculating the expansion of water in becoming steam, noticed by Mr. F. O. Ward, in your last number, arises from a slight error in one of the calculations, which should be as follows:—

	Grammes.
2 litres of H at 0·08936* = ...	0·17872
1 litre of O at 16 × 0·08936 = ..	1·42976
	1·60848

The 3 litres being condensed into 2, a litre of aqueous vapour at 0°C. and 760 mm. weighs..... $\frac{1.60848}{2} = 0.80424$

and hence (neglecting the slight expansion of water in cooling from its point of maximum density 0°) 1 litre of water at 0° would become $\frac{1000}{0.10424}$ or 1243·4 litres of aqueous vapour. The steam, however, being formed at 100°, will become expanded to $\frac{373}{273} \times 1243{\cdot}4$ or 1,699 litres, so that again neglecting the slight expansion of the water

* The weight in grammes of a litre of hydrogen at 0 deg. C. and 760 mm. pressure.—*Roscoe's Chemistry*, p. 19.

in heating from the point of maximum density to 100°, 1 litre of water at 100° becomes 1,699 litres of steam at 100°.

The vapour density of water (observed, air = 1·0000), and the weight of a litre of air at 0° and 760 mm. as given in Cooke's *Chemical Physics*, p. 693, are respectively 0·6235 and 1·29206 grammes; hence the weight at 0° and 760 mm. of a litre of aqueous vapour will be $1{\cdot}29206 \times 0{\cdot}6235$, or 0·8056 grammes, which does not differ much from the previous theoretical number 0·80424, and corresponds to an expansion at 100° of 1,696 times, since $\frac{1000}{0{\cdot}8056} \times \frac{373}{273} = 1{,}696$.

—I am, &c.,

CHARLES. R. A. WRIGHT, B.Sc.

Chemical Laboratory, St. Thomas's Hospital,
July 13th, 1867.

To the Editor of the Chemical News.

SIR,—The few editorial remarks which appeared in your issue of the 12th inst., induced me to look over Mr. Ward's statements on the above-named subject. I think I may safely advance that Mr. Ward has erred in this instance to the extent of the difference indicated between his numbers and the experimental results. Adopting the specific weights which he gives for the volume of the water constitutents, the weight of a litre of steam at 0°C., and ordinary pressure, would not be 7·2576 grms, as Mr. Ward states, but 0·8064 grm. It follows, therefore, that a litre of water would produce a volume of steam at 100°C., which, when corrected to 0° would amount to 1241·3 litres ($\frac{1000}{0{\cdot}8064} = 1241{\cdot}3$).

According to Mr. Ward's figures this volume should be 137·77 litres ($= \frac{1000}{7{\cdot}2576} = 137{\cdot}77$), although he enlarges the result to 1377·8 litres.

Gay Lussac's experimental determination of 1,700 litres as the volume a litre of water acquires when converted into steam by a temperature of 100° if corrected to 0°C. corresponds very nearly with the volume of 1241·3 litres, for $\frac{1700}{1{\cdot}3665} = 1244$.

The corrections to 0° cannot make any important difference in the ratios; and I may state that the relation of volumes deduced by theory, or obtained by experiment, would be coincident at any point intermediate between 0° and 100°. So far, therefore, we may believe that perfect harmony exists between the theoretical and experimental results in relation to the expansion of water into steam at 100°.

Indeed, it is beyond my capacity to comprehend how any difference could arise here, between theory and experiment, or that in the entire series of volume-ratios any discord or diversity could be educed under similar or analogous conditions to those referred to.—I am, &c.,

MARTIN MURPHY.

College of Chemistry, Liverpool, 13th July, 1867.

To the Editor of the Chemical News.

SIR,—The assertion that water expands 1696-fold in becoming steam at 212°F, rests on the authority of Gay Lussac, and is a result of direct experiment. He found that 1 c.c. of water gives 1626.4 c.c. of steam measured at 100°C.

Now, 2 litres of H weigh	0·1792
1 —— O ——	1·4336
	1·6128

1 litre of steam at 0°C weighs, then, 0·8064 grm. Hence, 0·8064 c.c. water at 4°C becomes 1000 c.c. steam at 0°C. and 1367 c.c. at 100°C., or 1 c.c. water becomes 1695.2 c.c. steam at 100°C.

The difference between theoretical and experimental results amounts thus not to 8 per cent, but to 0·08 per cent.

There are three errors in Mr. Ward's calculations, which, however, counteract each other rather curiously.

$16 \times 0{\cdot}0896 = 1{\cdot}4336$, not $14{\cdot}336$

$\frac{1000}{7{\cdot}2576} = 137{\cdot}78$ not $1377{\cdot}8$

I am utterly unable to understand the method adopted for the correction for temperature. I may remark, however, that the co-efficient of expansion of gases for 1°F, is

$$\frac{1}{491} \text{ and not } \frac{1}{460}$$

and that the correction should be made from 212°F. to 32°F., and not to 60°F.—I am, &c.,

W. M. WATTS, D.Sc.

Glasgow, July 16th, 1867.

To the Editor of the Chemical News.

SIR,—I observe some calculations under the above heading in this week's CHEMICAL NEWS. If Mr. Ward had made his calculations correctly, he would have had no difficulty in reconciling the fact that water expands 1,696-fold when converted into steam at 212° F., with the vapour density of water.

It is not necessary to point out all the errors of calculation. The following calculations will show most of them when placed in juxtaposition, and it is only necessary to state that the weights of hydrogen and oxygen are taken from "Bunsen's Gasometry."

	Grammes.	
2 litres of H at 0·08961 = ...	·17922	at 32° F.
1 litre of O = ...	1·43028	,,
2 litres of water vapour = ...	1·60950	,,
1 litre of do. = ...	·80475	,,

$\frac{1000}{{\cdot}80475} = 1242{\cdot}6$

$1242{\cdot}6 \times 1{\cdot}3665 = 1698{\cdot}0$ = volume of vapour at 212° F. from unit of water of maximum density (at 39.2° F). 1,696 has probably been arrived at by cutting off fractions; by multiplying 1,242 by 1·366 we get 1696·5.—I am, &c.,

D. H.

To the Editor of the Chemical News.

SIR,—In Mr. F. O. Ward's calculation of the vapour density of water a mistake occurs, which, if corrected, will remove the discrepancy noticed by him.

		Grammes.
2 litres H at	0.0896 =	0·1792
1 litre O at	16×0.0896 =	1·4336
		1·6128

3 litres becoming 2 we have $\frac{1{\cdot}6128}{2} = 0{\cdot}8064 = 9 \times 0{\cdot}089^6$ as the weight of 1 litre of steam at 0°C, and 760 mm. pressure. A litre of water weighing 1,000 grammes, at 4°C. or 999·88 grammes, at 0° will therefore give

$\frac{999{\cdot}88}{0{\cdot}8064} = 1239{\cdot}9$ litres steam at 0°C. and 760 mm. pressure.

Reducing the alleged 1,696 litres at 100° for temperature, we get $\frac{1696}{1{\cdot}367} = 1240{\cdot}6$ litres at 0° and 760 mm. pressure, or almost exactly the theoretical quantity, assuming steam to possess the same coefficient of expansion as atmospheric air, viz., 0·367 between 0°, and 100°, and under constant pressure. The *crith*, it should be remembered, is the weight of a litre of gas or vapour at 760 mm. pressure, and at 0°C., and not at 60°F.—I am, &c.,

A. D.

VAPOUR DENSITY OF WATER.—"CHEMISTRY OF THE FUTURE."

To the Editor of the Chemical News.

SIR,—I notice, with not unpleasurable surprise, that you have bestowed the honour of publicity on some remarks of mine, not penned with a view to impression, and

wanting, I see, some little revision. They refer to the discrepancy of the figures representing the vapour-density of water, as on one hand deduced from its received volumetric constitution, and as computed, on the other hand, by correcting, for temperature, the ordinary statement of the expansion of water in becoming steam at 212°F., viz., 1696-fold. The accidental misplacement of a decimal point, and a casual error in the reduction of boiling point to 60°F. have led to the working out of the discrepancy as greater than it really is. I subjoin the corrected figures, from which it will be seen that the discrepancy is still large; leaving me nothing to alter in the remarks founded thereon.

Computing the vapour density of steam from its volumetric constitution, we have :—

2 litres of H = 1 at 0·0896	0·1792
1 litre of O = 16 × 0·0896	1·4336
3 litres weighing	1·6128

These 3 litres being condensed into 2, we have

$$\frac{1{\cdot}6128}{2} = 0{\cdot}8064$$

as the vapour density required. As a litre of water weighs 1000 grammes, its expansion ratio, in becoming steam at ordinary temperature and pressure is obviously

$$\frac{1000}{0{\cdot}8064} = 1240$$

Turning now to the usually alleged expansion-ratio, 1696, and reducing it for temperature, at the rate of $\frac{1}{460}$ per degree F., for the difference between boiling point and 60°F = 120°, we have the ratio

$\frac{340}{460} \times 1696 =$	1253·5656
which, set against the above computed	1240·0000
Shows a discrepancy of	13·5656

This is the point to which I called my friends' attention, with reference to the question whether the volumetric relations of bodies are so symmetrical as is is our present disposition to suppose.

This touches a subject now strongly attracting the attention of the chemical world—I mean the nature and constitution of matter and the mode to be preferred of conceiving and representing its chemical transformations. With reference to these deeply interesting questions, I will ask your permission to cite here a letter which I received, more than 20 years ago, from Professor Faraday. I was at that time a youth at college, in the first ardour of my scientific studies, and I had devised—as most chemical tyros do, I believe—a fantastical theory of the nature of matter and of the forms and properties of its elementary particles, as also of the building up of these into compound molecules. No doubt I made my acid particles pointed and my sugary and oleaginous molecules round, taking care to provide my atoms with suitable facets whereby to fit one another in the construction of compounds, all which ordinary fluttering of my young chemical wings I must have deemed vastly profound and original, since I posted the paper, with high expectations, for the illustrious professor's judgment.

Two days afterwards I received a letter, on the corner of which I read, with a beating heart, the celebrated philosopher's signature. Being at present far away from my archives, I can but quote this letter from memory, yet I think I can give it you nearly *verbatim*, so profound was the impression made on my mind by its modest simplicity, contrasted with my boyish presumption, and so lasting was the philosophic lesson it conveyed. It ran nearly thus :—

"I have received your ingenious speculations on the nature of matter, and on the forms and properties of atoms; and, in reply to your question, I have no hesitation in advising you to experiment in support of your views, because, whether they be confirmed or confuted, good always comes of experiment.

"As to your views themselves, and my own opinion on the subject, I am fain to confess that I have thought long and closely on the theories of matter, and on the nature of its particles or atoms; and that, the more I think, in association with experiment, the less distinct does my idea of an atom or particle of matter become."

I have never known which most to admire in this letter—its modest wisdom, or the condescending kindness which prompted its writer to bestow on an obscure youth—to him a total stranger—so gentle yet impressive a monition.

But why is it cited now and here?

Because its marking words—"*in association with experiment*"—are, if I mistake not, particularly apposite to the present posture of chemical affairs.

The chemical world is, indeed, under invitation to embrace a new theoretic system, which incorporates, as an essential part of its fabric, the affirmation that several bodies, never yet decomposed, are compounds of a known with certain unknown elements; and, further, as regards the known elements themselves, that they are the results, some of one, others of two or more "*operations*," strangely likened to so many "strokes on a bell."

It would ill befit a mere student, like myself, of some of the simpler parts of chemistry, to criticise proposals brought forward by a recognised master of the science. Yet my admitted inferiority leaves me all the freer to confess that my dim conceptions of elementary matter derive no light from the suggestion that, in a "chemical operation," the evolution of hydrogen is attended, as it were, with *one* sound, and that of oxygen with *two*.

So, again, I may frankly avow that, to me, the proposed substitution of Greek for Roman letters, in our chemical symbols and formulæ, seems likely to impart to our hitherto attractive science, an aspect of abstruseness uncompensated by any *real* addition thereby made to the profundity of our knowledge.

Our real experimental acquaintance with the nature and constitution of hydrochloric acid, for example, remains unaltered, so far as I can see, whether we write it HCl, as of old, or denote it by the Greek symbol, $\alpha\chi$: and, for my own part, I feel the deep mystery of chlorine undiminished, when I am told, as the result of a series of equations, that

$$\chi = \frac{\mathrm{Cl}}{\mathrm{H}}$$

Still less, methinks, can the clearness of our physico-chemical conceptions and reasonings be promoted, by the two-fold interpretation which it is proposed to bestow, on the algebraic signs + and −. These, it would seem, we are invited to employ, sometimes in their old accustomed acceptation, sometimes as symbols of differences in "direction;" which differences, an arrow-head turned this way or that, would, I think, much more fitly represent.

By an equally gratuitous confusion of things different, the ordinary collocations signifying in algebra multiplication and division, are to be henceforth employed by chemists, not in those familiar senses only, but also as signs of chemical combination and decomposition. For my part, I must confess that I cannot trace the faintest analogy between the multiplication of one number by another, and the combination of two chemical elements; though here confusion can scarcely be avoided, the algebraists having, unadvisedly as I think, made the mere writing of two quantities in immediate succession the sign of their multiplication into each other. No such necessity can be pleaded to justify the use of the symbolic grouping $\frac{a}{b}$, heretofore set apart to express the division of one quantity by another, as the sign of so utterly dissimilar a conception as that of chemical

decomposition, which we are, nevertheless, invited to write in much the same manner — putting $\frac{Cl}{H}$, for instance, to signify the decomposition of hydrochloric acid. If symbols of chemical combination and severance be needed, why not devise some simple forms of expression for the purpose; as, for example, marks of parenthesis, ordinary and reversed, the former for combination—(HCl), the latter for decomposition—H)(Cl. Surely this, or some equivalent expedient, would be more philosophical than the forcing into an artificial quasi-connexity, of facts and conceptions so utterly incongruous, as to be absolutely incomparable.

I own myself at a loss to discover the additional profundity of reasoning assumed to be derivable from this ambiguous duplication of the meaning of symbols hitherto received, each only in a single sense. This mixing up of algebraic and chemical symbols, so far from assisting ratiocination in either kind, will rather tend, I think, to increase the toil of chemical thought, and to multiply the chances of chemical error, by the additional stress gratuitously imposed on the chemist's attention, thus called on, as it will be, to catch correctly so many alternating modes of interpretation, each in its variable turn.

As for the new "fundamental definition" of a chemical phenomenon, it is "an operation on the unit of space, the result of which is a weight." I confess that, for me, this play of words throws not the faintest ray of light on any of the familiar marvels of chemistry, such as solution, effervescence, crystallisation, explosion, and all the numberless transformations of form, colour, combination, properties, &c., which collectively make up our astonishing science. In what sense is the above definition more luminous, more explanatory of the wonders amidst which we move, than if one should say, conversely, that a chemical phenomenon results from the operation of a weight (or weights) within given limits of space (and time). There is no limit to the multiplication of such abstractions, and if that now propounded gains acceptance, I cannot see why, to-morrow, a new Transcendental school may not be started, with a modified "fundamental definition," declaring a "chemical phenomenon" to be an "operation upon the unit of Time, the result of which is a Force."

Such expressions may be more or less neat and antithetic, but they afford us not the slightest insight into those hidden ways of nature which they affect to fathom and reveal. The *essence* of natural phenomena is, indeed, unknowable; we may study their relations, and ascertain the conditions of their existence, so as to obtain means for their modification and control, but when we seek, with subtle phrases, to express their absolute nature and causation, we do but disguise our ignorance and cheat our yearning curiosity with words. Of such kind appears to be the abstract definition of chemical phenomena now put forward to fit our science for the new analytical method proposed; and unless this apprehension should prove to be ill-founded, the new system will do little, I fear, towards promoting the real inductive progress of chemistry.

Far be it, however, from me to deprecate the introduction into chemical science of any high analytical method, if such there be, really compatible with its eminently concrete and experimental character, and really calculated to support the arduous reasoning of chemists through further-reaching concatenations than have heretofore been possible for them. But no such transcendental methods will avail, unless, as Faraday enjoins, they be used in constant "association with experiment," and due subjection to its wholesome check.

This rule would, I think, be as seriously infringed by the premature acceptance of chlorine, and a series of cognate bodies, as compounds of hydrogen with various unknown elements, as it would have been, if, in Sir Humphrey Davy's time, the suspected composite character of the alkalies had been elevated to the dignity of an established fact before its reality had been demonstrated by Davy's ever memorable experiments.

I would not, however, be understood as seeking, by any means, to undervalue or disparage the intellectual power displayed by the eminent propounder of the new doctrine, in his vigorous assault on the so-called "Chemistry of the Past," and equally cogent demonstration of the necessity for a higher and larger "Chemistry of the Future." In this proposition all chemists are, I think, agreed. It has long been felt by philosophical reasoners—Auguste Compte among the number—that the atomic theory fails to satisfy our intellectual requirements, when it is applied to the interpetration of *organic* chemistry, though it has answered its purpose admirably as a means of intelligibly connecting the main facts of *inorganic* chemistry. We, therefore, need a unitary conception, of more comprehensive scope, capable of embracing, under common forms, the facts of both divisions of the science, and adapted to make manifest their intrinsic harmony, not only with each other, but also with the recent developments of physical science, such as, for instance, the lately proved convertibility of motion into force, and *vice versa*.

It is not, therefore, in any captious dislike of innovation, still less in a cavilling or disrespectful spirit, that I have ventured to submit what seem to me objections to the system now proposed. My attitude is rather that of a student who, after a perplexing lecture, lays his doubts, with deference, before his professor. I feel anxious lest chemical philosophy, at this juncture, should be led into a false, though brilliant path; lest, in striving after analytical methods, possibly unsuited to a science so essentially concrete and experimental, we should barter solid facts for metaphysical subtleties, and only, after all, make chemistry more abstract, at the cost of making it less real.

Like my chemical betters, however, I await, before finally judging the new system, its full and complete development; and I shall be found among its first and most grateful devotees, should it open up new spheres of really *positive* reasoning and research, and tend to facilitate (in Faraday's pregnant phrase) "THOUGHT ASSOCIATED WITH EXPERIMENT."

F. O. WARD.

MISCELLANEOUS.

Obituary.—Our readers will probably have already seen the announcement of the death, and have lamented the loss, of Dr. Thomas Richardson. Dr. Richardson was Reader in Chemistry at the University of Durham, as well as a Fellow of the Royal Societies of London and Edinburgh, and member of the Royal Irish Academy. He died somewhat suddenly, at Wigan, on the 10th inst., of congestion of the brain. Of late years Dr. Richardson was best known to the chemical world by his work in connection with "Richardson and Watts' Chemical Technology." Several papers of his are to be found in the volumes of this Journal and the *Chemical Gazette*. They relate chiefly to manufacturing chemistry. Many chemists will have pleasent reminiscences of their visit to the Newcastle meeting of the British Association, and of Dr. Richardson's hospitality on that occasion.

NOTES AND QUERIES.

Vapour Density of Water.—In reference to this subject a correspondent draws attention to a work published many years ago, by order of the French Government, containing the results of the very elaborate researches, made by V. Regnault, on the density, &c., of steam. Our correspondent does not mention the title of the book, but he says that in it the subject mooted by Mr. Ward is fully and conclusively set forth.

*** Owing to great press of matter, "Notes and Queries" and "Answers to Correspondents" are unavoidably postponed. With reference to Mr. Ward's figures in our last number, we feel it right to mention that we printed them from a private note, evidently written off-hand, and unrevised: as also that the writer's corrected version reached us by the post following that by which the* CHEMICAL NEWS *would come into his hands, and antedated the other letters on this subject. The fact of Mr. Ward's letter following instead of preceding the other letters occurs in accordance with a rule adopted in most printing offices, when there are several communications on the same subject, of placing the shortest first.*

THE CHEMICAL NEWS.

Vol. XVI., No. 399.

CHEMICAL PRIZES.

The custom of offering prizes for the successful solution of problems in chemistry, is one which deserves some attention in this country. On the Continent it is not rare to find chemical manufacturers, or directors of large works where a particular operation in testing or analysis has to be performed many times a day, resort to the expedient of publicly offering a prize for the discovery of a process which shall fulfil certain prescribed conditions. This plan has several advantages. In most large chemical works there is one operation which has to be performed almost hourly, and on the accuracy and dispatch of which much money is risked. It is impossible for any chemist attached to the establishment to be acquainted with all the improvements which are being made in a particular process, and his time is generally too much occupied in routine work, to admit of his carrying out the experiments necessary for the working out of minor details. A publication of the difficulty through the agency of the scientific press, is often sufficient to bring forward many good suggestions, and we can point to our own "Notes and Queries" column in illustration of the readiness with which chemists will assist each other in the elucidation of a technical problem.

This plan, however, of asking for advice is obviously of limited use. Although any of our readers would, we doubt not, be willing to give a querist information when he could do so by simply writing a letter to our columns, few would feel inclined to enter gratuitously into an investigation, and occupy their time for some weeks, to solve a technical problem simply for the benefit of a manufacturing firm. Hence the system of offering prizes appears especially appropriate, and in many instances the expenditure of £50 or £100 has secured to the manufacturer an analytical process which has saved the outlay many times in the year.

A prize of 300 thalers has just been offered by the Mansfeld Copper Mining Company, Eisleben, for the discovery of a process for the estimation of copper in the Mansfeld schist, the following conditions being fulfilled:—The process must not occupy more than five or six hours, including all operations. One person must be able, without much exertion, to finish at least eighteen analyses daily. The differences between the analyses must fall within narrow limits. All the claims for the prize, with full particulars, are to be sent to the Company before the end of December next. The decision will be announced on June 30, 1868, and if any of the processes sent in fulfil the requisite conditions the prize will be forthwith paid, but should several be found which appear eligible, to the best will be awarded 200 and to the second 100 thalers. If, however, no satisfactory process is discovered, it is intended that the prize shall be divided amongst those who have sent in the best investigations on the subject. The successful processes are to remain the property of the Company.

A few months ago we drew attention to the fact that one of the largest and most extensive manufacturers of tartaric acid would give £100 as a reward to any one who would discover a satisfactory method of determining, directly, the quantity of crystallisable tartaric acid present in tartars, in a sufficiently ready manner to be applicable to commercial analysis; the name of this firm has not been made public, but should any of our readers wish to know more accurately the conditions of the prize, they can address a private letter to our office.

It is, perhaps, not premature to mention that in all probability a money prize will shortly be offered through the Chemical News, for the discovery of a somewhat similar process of technical analysis, connected with an important branch of manufacture. The details are now under consideration.

ON THE

RECOVERY OF SULPHUR FROM ALKALI WASTE.

By LUDWIG MOND.

(Concluded from p. 28).

Firstly, I wanted an easy and rapid method of determining the quantity of acid necessary for the decomposition of a given quantity of liquor, which always contains hyposulphite, polysulphide, and hydrosulphide of calcium and sodium. For this end I availed myself of the following method:—

1. The hyposulphite is determined as usual by a standard solution of iodine and starch, after having first separated the polysulphide and hydrosulphide by adding an excess of chloride of zinc, and filtering.

2. To a certain quantity, say 3·2 c.c. of the original liquor, and starch, is added a standard solution of iodine until it turns blue, the liquor is then again decoloured by a drop of hyposulphite of soda solution, and litmus, and a standard solution of caustic soda are added until the liquid is neutral.

The following reactions take place:—

$$2CaO,S_2O_2+I=CaI+CaO,S_4O_5,$$
$$CaSx+I=CaI+xS,$$
$$CaS,HS+2I=CaI+S+HI,$$
$$HI+NaO=NaI+HO.$$

Thus the caustic soda corresponds to the sulphuretted hydrogen, the iodine used in the first titration to the hyposulphite, and from the iodine used in the second titration and the two former numbers the calcium present in the form of sulphide is easily calculated.

Using for both titrations 3·2 c.c. of liquor, and standard solutions containing one-tenth of an equivalent per litre, and presuming that the polysulphide is bisulphide only, we have simply to add the measures of iodine used in both determinations, to subtract the measures of caustic soda, and divide this number by ten, in order to find the total percentage of sulphur in the liquor, from which the muriatic acid is easily calculated, every 32 of sulphur requiring 36·5 of hydrochloric acid.

Generally, the polysulphide contains very little more than 2 equivalents of S to 1 of Ca, so that this method is also sufficiently exact for the determination of the sulphur in the liquors, for practical purposes.

Though this method has been proved to be perfectly correct by a number of accurate experiments, the muriatic acid, as calculated by it, was still more than was actually required to effect a complete decomposition of the liquor. A number of careful investigations made with the view of explaining this fact, have shown that, contrary to the assertions of all chemical handbooks, the products of the decomposition of hyposulphite of lime by muriatic

acid are, comparatively little sulphur and very little sulphurous acid, but principal trithionic acid, and a small quantity of pentathionic acid. The reaction was proved to take place principally according to the following equation :—

$$5CaOS_2O_2+3HCl=3CaCl+3HO+2CaOS_3O_5+4S.$$

On boiling, the trithionate of lime is decomposed to sulphate of lime, sulphur, and sulphurous acid. The latter transforms a portion of the hyposulphite, which is still in the liquor, again into trithionate, acording to the well-known equation :—

$$2CaOS_2O_2+3SO_2=2CaOS_3O_5+S.$$

The newly-formed trithionate is again decomposed, and so on. In consequence of these reactions it is possible to decompose a solution of hyposulphite of lime completely into sulphur, sulphate of lime, and very little sulphurous acid, by adding to it when boiling a quantity of muriatic acid sufficient to neutralise about one-half of the lime in solution.

In places where hydrochloric acid has a comparatively high value, these facts may be taken advantage of. As, however, at the present moment, fully one-half of the acid produced by the decomposition of salt is run into the rivers, or passes into the air, and as, besides the above-quoted reactions involve a very heavy loss of sulphur in the form of sulphate of lime, and produce also a very impure sulphur, I prefer the following plan, which avoids these inconveniences.

The oxidation of the waste is regulated so as to obtain a liquor, which contains as nearly as possible to every equivalent of hyposulphite, two equivalents of sulphide. This liquor is decomposed by first adding to a certain small quantity of acid an excess of liquor, until there is a trace of sulphide in the mixture; then a quantity of acid sufficient to neutralise the whole of the calcium is poured in, a new quantity of liquor equivalent to this last qnantity of acid is added, and then acid again, and liquor again, and so on, until the vessel is nearly filled. To the last liquor only one-half of the required acid is added, and steam introduced, until the liquid shows a temperature of about 140°F. Practically speaking, the liquor and the acid are poured at the same time into the decomposing vessel in nearly equivalent proportions, the workmen taking care to keep a small excess of liquor up to the end of the operation. This part of the process is carried on in wooden tanks covered in and connected to a chimney, in order to carry off any sulphuretted hydrogen which may be evolved by mistake of the workman. If properly carried out there should be, however, no appreciable quantity of that gas evolved.

The practical result of this mode of working is simply precipitation of nearly the whole of the sulphur in a pure state.

$$CaO,S_2O_2+2CaSx+3HCl=3CaCl+3HO+(2+x)S$$

The details of the reaction, are, however, very complicated, almost all the different acids of sulphur being probably formed during the process.

In the first place, by adding liquor to acid, some sulphuretted hydrogen is given off (which may be avoided by starting the operation with liquor rich in hyposulphite) and hyposulphurous acid is set free, which will give rise to the formation of sulphurous and several thionic acids. All these are, however, again converted into hyposulphite by the sulphide of calcium in the liquor, then added in excess.

$$3SxO_2+2CaSy=2CaO,S_2O_2+(3x+2y+4)S.$$
$$3SxO_5+5CaSy=5CaO,S_2O_2+(3x+5y+10)S.$$

The muriatic acid entering next, thus only produces hyposulphurous acid, and its products of decomposition, which are again converted into sulphur and hyposulphite without the formation of any gaseous product, and so on. At the end there is a certain quantity of hyposulphite left in the liquors, which is decomposed into sulphate and sulphur by adding an insufficient amount of muriatic acid. In practice about 90 per cent of the muriatic acid, calculated according to the above described method, are required to effect thus the complete decomposition of a well-proportioned liquor. If it contains more hyposulphite than above indicated, less acid is, of course, to be used. About 90 per cent of the sulphur contained in the liquor is precipitated in an almost pure state, and settles exceedingly well within two hours. The supernatant clear solution of chloride of calcium is then drawn off, and another operation directly commenced in the same vessel. As soon as a sufficient quantity of sulphur is collected in it, which will depend on the size of the vessel and on the strength of the liquor (varying from 4 per cent to 7 per cent of sulphur), it is drawn out by means of a door at the lower part of the vessel into a wooden tank with a double floor, where the chloride of calcium is washed out by water, and the sulphur then simply melted down in an iron pot. The product thus obtained contains only from $\frac{1}{10}$ per cent to 1 per cent of impurities, and is thus by far superior to any sort of brimstone in the market, though it has sometimes a rather darker colour caused by traces of sulphide of iron, or a little coal dust, which latter may have been suspended in the muriatic acid.

The total yield of sulphur obtained by the process amounts thus to 10 or 11 per cent of the weight of the salt-cake used in making black ash, or to about $\frac{1}{2}$ of the sulphur therein contained, and to about 60 per cent. of the sulphate contained in the waste. I still hope, however, to be able to increase this quantity considerably by some more years experience. The cost of production, as well as that of the plant, are inconsiderable. In the different continental and English works, where the process has now been working for years, the expense for wages, fuel, and maintenance amounts only to £1 per ton of sulphur, and the outlay for the plant has been more than covered by the net profits of the first year.

The two other processes represented at the Paris Exhibition are, as stated, based on the same principle.

M. Schaffner oxidises the waste in heaps, exposing it for several weeks, lixiviates, and repeats this treatment three times. He decomposes his liquor by adding muriatic acid, after having heated it to the boiling point, conducting the sulphurous acid formed into a vessel filled with fresh liquor, and thus producing sulphur mixed with large quantities of sulphate of lime, as above stated. This impure sulphur he refines in a very ingenious way by melting it under water in a closed vessel provided with an agitator, thus obtaining a product of remarkably fine colour and great purity. This process has been adopted in a number of German works. Mr. P. W. Hofmann oxidises the waste by spreading it on a large surface and moistening with a solution of chloride of manganese in order to facilitate the oxidation, which, however, requires some weeks before it is completed. He then lixiviates, and in order to separate sulphur from the liquors so obtained, he avails himself of the muriatic acid contained in the waste liquor of bleaching-powder stills, as has already been proposed by Messrs. Townsend and Walker, in 1860. He mixes these liquors in such proportions as just to saturate the free acid, and thus obtains a product containing about 92 per cent of sulphur. This process is in operation at the alkali works at Dieuze in France.

Besides these, a considerable number of patents have been taken out for inventions in the same direction, which, however, contain no new facts of importance bearing on our subject, and most of which, apparently, have never been worked out.

The most successful of them has probably been that of Mr. Benjamin Jones, a workman who assisted me in working my process out on a large scale in 1863, at the works of Messrs. John Hutchinson and Co., in Widnes. One of the three patents which he took out between December, 1863, and May, 1864, has been worked for a short time in Warrington, but was however quickly abandoned.

ON THE SUPPOSED NATURE OF AIR PRIOR TO THE DISCOVERY OF OXYGEN.

By GEORGE FARRER RODWELL, F.C.S.

(Continued from p. 31).

In the *Philosophical Transactions* for 1686, we find a paper entitled, "An Account of an Experiment shown before the R.S., of Shooting by the Rarefaction of the Air," by Dr. Denys Papin, R.S.S. Otto Von Guericke had previously described a similar invention, but Papin's gun was considered more effective. It consisted of a long tube fitted with suitable valves. It was exhausted by an air-pump, and the external air was suddenly admitted. By this means a bullet weighing two ounces was propelled with great velocity to a considerable distance.

In the *Philosophical Transactions* for October, in the same year, Papin gives "A demonstration of the velocity wherewith the air rushes into a vacuum." The Academie des Sciences had previously endeavoured to determine the relative velocities of air and water under similar conditions, by filling a bladder first with water, then with air, applying a like pressure, and noting the time necessary to empty the bladder respectively. It was thus found that the bladder of air could be emptied in one twenty-fifth the time necessary to empty the bladder of water, and it was hence concluded that with equal orifices and pressures the velocity of air is twenty-five times greater than that of water. But for many reasons stated by Papin this method is most erroneous. The following mode of demonstration was adopted by Papin. It had been proved that the heights to which dissimilar liquids will be driven by the same pressure will be reciprocally as the specific gravity of the liquids; thus a pressure which causes mercury to rise to a height of one foot will cause water under the same conditions to rise to a height of $1 \times 13{\cdot}5$ feet. From Galileo's demonstration that the velocities of bodies are as the square roots of the heights to which they would ascend, it follows that the velocities of two dissimilar liquids is as the square root of their respective specific gravities. Now the pressure of the air is equal to that of a column of water 32 feet high, which would rush out with a velocity of 45 feet per second. The specific gravities are as 840 to 1, and the roots as 29 to 1; therefore the velocity of air is 29 times greater than that of water under similar conditions; hence he concludes that the velocity of air driven by the whole pressure of the atmosphere, or in other words the velocity of air entering a vacuum, would be $45 \times 29 = 1{,}305$ feet per second.

Papin continued to act as Curator to the Royal Society till the year 1687, when he was appointed Professor of Mathematics in the University of Marburg, an appointment which he held until his death, in 1714.

Although Papin did not do much by direct means to further pneumatics, he did much indirect service to the science by the invention and improvement of apparatus. It is strange that the invention of the double-barrelled air-pump should be so frequently attributed either to Boyle or Hauksbee; the error is probably due, on the one side, to the fact that the first account of it was published in a work which claimed Boyle for its author; and in the second place because it was improved and first perfectly figured by Hauksbee, and by him brought into general use. Winkler* of Leipsic, while he is most cautious to mention the slight improvements introduced by Sengwerdus, Wolfius, Leupold, S'Gravesande, and Muschenbroek, does not so much as mention Papin. The air-pump as Papin found it possessed but one barrel; one at least of its valves was worked by hand; and the receiver had to be cemented to the pump-plate before the commencement of each experiment. As he left it, it possessed two pump-barrels, fitted with self-acting valves; a ground pump plate upon which a receiver with ground edges could remain air-tight without the necessity of cement; and a connection was established between the pistons, so that the descent of one effected the elevation of the other.

We can scarcely be surprised that Papin did not greatly extend our knowledge of the nature and properties of the air, for the above extracts from his works clearly show us that his object was to apply the air-pump to useful purposes, rather than to extend pure pneumatical research. He was prouder of his "Digester of Bones?" than of his double-barrelled air-pump; and he preferred the experiments on the preservation of fruits, to the "demonstration of the velocity wherewith the air rushes into a vacuum."

We may mention *en passant*, that Papin was one of the first to adopt the important theory of combustion (since completely verified), of "Ce très subtil Anglois M. Robert Hook," as he calls him.

*Vide his *Aufangsgrunde der Physic.* Leipsic, 1754, translated into English in 1757.

ON THE QUANTIVALENCE OF CHLORINE AND OTHER REPUTED MONADS.

By JOHN A. R. NEWLANDS, F.C.S.

THE difficulties with regard to the formation of certain compounds, which have been lately pointed out by Dr. Odling and others, seem to indicate that chlorine and other reputed monads must really possess latent bonds, and be capable of acting as triads, &c., under peculiar circumstances. Thus, in the union of ammonia and hydrochloric acid the nitrogen acts as a pentad, and, if we regard the hydrogen and chlorine in hydrochloric acid as monads, the hydrochloric acid must be decomposed in order that its hydrogen and chlorine may unite with nitrogen, an element for which they have but slight affinity. On the contrary, if we admit that chlorine may act as a triad (just as iodine does in ICl_3), we may suppose that two of its bonds are latent in H Cl, and that on bringing HCl in contact with NH_3 the two latent bonds of the Cl unite with the two latent bonds of the N. Or, we may suppose that the Cl in HCl remains a monad, and that the H acts as a triad having two latent bonds, which on the approach of NH_3 serve to unite it with the two latent bonds of the N. This latter view of the constitution of sal-ammoniac, and similar bodies, is, perhaps, preferable, as it represents the H of the HCl as directly united to the N of the NH_3.

It may be said that if this view holds good regarding the union of HCl and NH_3, it ought to hold good with regard to the union of ethylic iodide, C_2H_5I, with NH_3, and that either the I or one of the five atoms of H in the ethylic iodide acts by virtue of two latent bonds, and so unites itself with the two latent bonds of N in NH_3.

For the purpose of the present communication, I admit, in accordance with the views of Frankland and others, that multivalent elements may have their apparent quantivalence reduced by successive pairs of bonds becoming latent. Thus N is a pentad in NH_4Cl, a triad in NH_3, and a monad in ON_2, and C is a tetrad in CH_4 and a dyad in CO, still N is always a perissad and C always remains an artiad.

These views, however, may be extended by considering it possible for a monad, by the development of two or more pairs of latent bonds, to become a triad, a pentad, a heptad, &c., still, however, remaining a perissad. In like manner, we may consider it possible for a dyad, by the development of two or more pairs of latent bonds, to become a tetrad, a hexad, an octad, &c., still, however, remaining an artiad.

So that all perissads may really have the same number of bonds (that number being an odd number), and may differ only by the number of pairs of latent bonds which their atoms respectively possess, under ordinary circum-

stances. Again, all artiads may really have the same number of bonds (that number being an even number), and may differ only by the number of pairs of latent bonds which their atoms respectively possess under ordinary circumstances.

Thus I, which is a monad in KI, becomes a triad in ICl_3; B, which is a triad in BF_3, becomes a pentad in BKF_4; Pt, which is a dyad in $PtCl_2$, becomes a tetrad in $PtCl_4$, and an octad in PtK_2Cl_6; and Si, which is a tetrad in SiF_4, becomes an octad in SiK_2F_6.

In the following table certain compounds of the monads with O, &c., are given, which are analogous to the compounds of triads and pentads placed alongside of them. I am aware that too great stress must not be laid upon such facts, inasmuch as the number of atoms of O combining with an element, affords us no absolute proof of its quantivalence:—

H_2O ..	Cl_2O ..	K_2O ..	N_2O
H_2O_2 ..	K_2O_2 ..	N_2O_2	
Cl_2O_3 ..	N_2O_3 ..	P_2O_3	
Cl_2O_4 ..	K_2O_4 ..	N_2O_4	
I_2O_5 ..	N_2O_5 ..	P_2O_5	
$KClO_2$ ..	KNO_2		
$HClO_3$ ..	HIO_3 ..	HNO_3 ..	HPO_3
ICl_3 ..	PCl_3		

This table might easily be enlarged to a considerable extent, but I think the above will be sufficient to render the view probable that reputed monads may, under certain circumstances, play the part of triads and pentads. This is certainly the case with I in ICl_3, and the privilege we accord to I we cannot well refuse to Cl, Br, or even to H itself.

Laboratory, 19, Gt. St. Helens, E.C.

ON THE

UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

(Continued from page 32).

III.—Coal Tar.

This is a very complex liquid, for it contains at least three classes of compounds—viz., acids, neutral bodies, and alkaloids, the composition and leading properties of which are as follows:—

Acids of Coal Tar.

Names.	Formulæ.	Specific Gravities.	Boiling-points (Fahr.)
Acetic	$C_4H_4O_4$ ..	1062	.. 243°
Butyric	$C_8H_8O_4$ ..	973	.. 314
Carbolic	$C_{12}H_6O_2$ ..	1065	.. 370
Cresylic	$C_{14}H\ O_2$ ..	—	.. 397
Phlorylic	$C_{16}H_{10}O_2$ ..	—	.. 424
Rosolic	$C_{24}H_{12}O_6$ ..	—	.. —
Brunolic	? ..	—	.. —

Neutral Bodies of Coal Tar.

Alliatous oils ..	?	?	.. ?
Benzole	$C_{12}H_6$ ..	850	.. 177
Toluole	$C_{14}H_8$ ..	870	.. 230
Xylole	$C_{16}H_{10}$ ..	867	.. 264
Cumole	$C_{18}H_{12}$ ..	870	.. 299
Cymole	$C_{20}H_{14}$ ..	861	.. 341
Naphthaline ..	$C_{20}H_8$ ..	1153	.. 428
Anthracine	$C_{28}H_{10}$ ..	1147	.. 572
Pyrene	$C_{30}A_{12}$ ..	—	.. ?
Chrysene	$C_{24}H_8$ ..	—	.. ?

Basic or Alkaline Bodies of Coal Tar.

Pyridine	$C_{10}H_5N$ ..	986	.. 242
Pyrrol	C_8H_5N ..	1077	.. 272
Picoline	$C_{12}H_7N$ ..	961	.. 271
Lutidine	$C_{14}H_9N$ ..	946	.. 310
Collidine	$C_{16}H_{11}N$ ..	937	.. 354
Parvoline	$C_{18}H_{13}N$ ..	—	.. 370
Aniline	$C_{12}H_7N$ ..	1080	.. 360°
Toluidine	$C_{14}H_9N$ ..	—	.. 388
Xylidine	$C_{16}H_{11}N$ ..	—	.. 418
Cumidine	$C_{18}H_{13}N$ ..	952	.. 437
Cymidine	$C_{20}H_{15}N$ ..	—	.. 482
Chinoline	$C_{18}H_7N$ ..	1081	.. 462
Lepidine	$C_{20}H_9N$ ..	1072	.. 510
Cryptidine ..	$C_{22}H_{11}N$ ..	—	.. 525

The general properties of coal tar, as well as the proportions of its several constituents, vary with the quality of the coal used, and with the temperature at which it is distilled or carbonized. The tar which is produced from common gas coals at rather high temperature is always heavier than water (sp. gr. 1120 to 1150). It dries freely in the air, and its hydrocarbons are so rich in carbon that the tar cannot be burnt in an ordinary lamp. But the tar which is produced from cannel coal at lower temperatures is lighter than water, and does not readily dry when it is exposed to the air. Besides which, its hydrocarbons are comparatively poor in carbon, and may be burnt in lamps. There is almost every variety of coal tar from these two extremes, but the tars of commerce are chiefly of three kinds—viz., the rich cannel coal tar of Scotland; the tar which is produced from common coal in country gas-works, where the temperatures are generally low; and the still heavier tar of the London gas-works, which is produced at excessively high temperatures. The yield of tar per ton of coals is from 9 to 15 gallons—the latter being the average at country works; and the former, or from that to 10 gallons, is the yield in London, where the tar is undoubtedly affected by the high temperature of the retorts, for it is not only small in quantity, but it is deficient of naphtha, and contains more pitch than country tar; besides which, the dead oil from it is always overloaded with naphthaline.

In London the distillation of coal tar is always effected in stills, which are placed over a fire, and the products are collected at different stages of the distillation. Up to a temperature of from 160° to 190° Fahr. little or nothing flows over, but at that temperature ammoniacal liquor, with *crude naphtha* of a gravity of 850, begins to distil. These continue to flow until the thermometer rises to from 310° to 340°, when a heavier naphtha of a gravity of about 920 is carried over. This is called *light oil*, and it is collected separately until the temperature rises to from 370° to 400°, and then the oil begins to have the gravity of water; after that, and up to the temperature of from 690° to 700°, the oil which is collected is heavier than water, and is therefore called *heavy oil* or *dead oil*—the last runnings having a gravity of 1060 or thereabouts. If a soft pitch is wanted the process of distillation is stopped at this stage, but if a harder pitch is required it is pushed a little further, and the *green oil* which flows over is rich in neutral oils, which are well suited for making railway grease.

A still containing 2,500 gallons of coal tar will in this way yield about the following proportions of the several products:—

Ammoniacal liquor	from 50 to	70 gals.	(average) 60 gals.
Crude naphtha ..	30 ,,	50 ,,	,, 40 ,,
Light oil	12 ,,	35 ,,	,, 30 ,,
Creosote or dead oil	689 ,,	740 ,,	,, 720 ,,
Pitch	8 ,,	10 tons	,, 9 tons.

Each of these products has its commercial value, the naphtha and light oil being used for the production of benzole and toluole of commerce—naphthas which are largely in demand for the manufacture of coal-tar colours.

Formerly the greatest value was attached to the naphtha or benzole which had a low boiling-point, and the contracts, especially with the French, were for a benzole or naphtha which yielded 90 per cent of volatile oil at a temperature not exceeding 212°, and I have examined thousands of gallons of this quality for the French market. Even at the present time there is a demand for

this, which is called 90 per cent benzole, for making certain aniline reds; and to obtain it the crude naphtha, or the first runnings from the tars, were distilled alone. At present, however, there being a demand for a less volatile oil, the practice is to mix together the crude naphtha and the light oil, and to subject them to fractional distillation, thus:—Steam is blown into them at a pressure of from 20 to 30lbs. on the inch, and the naphtha which comes over with the steam is called *once run naphtha*. This is purified by shaking it with strong sulphuric acid (sp. gr. 1845), using the acid in small proportions at a time, for fear of injuring the naphtha, and washing with water between each operation. In this manner, after using about 5 per cent of acid (or ½ lb. to each gallon of naphtha), the brown colouring matter of the naphtha and all basic compounds are either destroyed or removed, and the brown naphtha, after being well washed with water, is again distilled by blowing high-pressure steam into it, and the products are collected at three stages; that which comes over first is called *crude benzole of 80 per cent strength*, the second runnings are a naphtha containing 50 *per cent of benzole*, and the third is a naphtha which is used for solvent purposes. With the view of strengthening the 50 per cent benzole, and making it 80 per cent, it is redistilled from a vessel with a steam jacket, whereby the temperature can be regulated. That which flows over at a temperature up to 210° is set aside as 80 *per cent. benzole*; that which distils between 210° and 260° is called 30 *per cent naphtha*; and the residuum, on being treated with high-pressure steam yields *solvent naphtha*. Once more the 30 per cent. naphtha, or that which has flowed over at from 210° to 260°, is distilled with a dry steam heat, and when the thermometer has risen to 106° there is obtained a little more 80 per cent. benzole; after which, and up to 234°, there flows over what is called 40 per cent. naphtha, and from 234° to 260° a little of the 30 per cent. Steam is then blown into it, and it yields a little more of the solvent naphtha.

In this way, by a series of fractional distillations, the washed naphtha is made to yield at each successive operation a quantity of 80 and 40 per cent naphtha. All the 80 per cents are then mixed together, and are once more distilled by a dry steam heat. The naphtha which flows over at a temperature up to 204° is called 90 per cent. benzole; that which flows between 204° and 210° is called 80 per cent benzole, and is again fractionally distilled up to 204°; while the residue, on being treated with high pressure steam, yields a quantity of 40 per cent naphtha.

Five separate products are thus obtained—namely, 90 per cent benzole, 40 per cent benzole, solvent naphtha, the last runnings of the first operation, and the residuum of each distillation. Operating in this manner with a charge of 1,587 gallons of crude naphtha and light oil, there is first obtained 897 gallons of once run naphtha and 56 gallons of the last runnings, the remainder (634 gallons) being a residuum of no value except for mixture with dead oil; and the 897 gallons of once run naphtha yields, after it has been purified with sulphuric acid, 301 gallons of 90 per cent benzole, 195 gallons of 40 per cent 237 gallons of solvent naphtha, 12 gallons of last runnings, and 152 gallons of residuum.

The 40 per cent benzole contains also 50 per cent of volatile oil, chiefly toluole, which distils over between 212° and 248°. This is the oil which is preferred at the present time for the manufacture of coal-tar colours. The several products which are thus obtained in the distillation of coal tar are upon the table before you, and roughly speaking, the proportions per 10,000 gallons of crude tar and their commercial values are as follows:—

40 per cent. benzole ..	34·4 gals.,	worth 2s. 4d.	per gal.
90 per cent. ,, ..	53·1 ,,	,, 2s. 0d.	,,
Solvent naphtha	41·8 ,,	1s. 9d. to 2s.	,,
Last runnings	12·0 ,,	,, 0s. 9d.	,,
Dead oil	3018·7 ,,	,, 0s. 1d.	,,
Pitch	36 tons	,, 45s. 0d.	per ton.

Before rectification the crude naphtha is worth about 1s. per gallon, and the light oil about 6d., the two together fetching 9d. or 10d. a gallon; and once run naphtha is worth 1s. 6d. a gallon. Two samples of this oil from different distillers yielded by fractional distillation the following per centage of proportions of oil at different temperatures:—

	Sample 1.	Sample 2.
Up to 212° Fahr.	15·0	17·5
From 212° to 248°	44·0	42·0
,, 248° to 264°	8·0	8·5
,, 264° to 300°	13·0	13·0
,, 300° to 320°	5·5	4·5
Residuum..	14·5	14·5
	100·0	100·0

The samples, therefore, in commerce from good markets may be regarded as of pretty uniform quality.

In Scotland the method of distilling coal tar is a little different from what it is in England, and this arises from the circumstance that the Scotch cannels yield a tar which is so rich in the volatile naphthas that it is not altogether safe to distil the tar from a still with a naked fire. The tar, therefore, is first submitted to the action of high-pressure steam, which is blown into it until the more volatile products are passed off. In this way from 7 to 13 per cent of *crude or rough naphtha* is obtained with a gravity of about 930. The residuum is called boiled tar, and is distilled with a naked fire. It thus yields from 6 to 7½ per cent of a *light oil* called *pitch oil* or *torch oil*, which has a specific gravity of from 973 to 976. The next runnings, which amount to from 27 to 30 per cent of the boiled tar, are generally heavier than water, and are called *heavy pitch oil*, and they constitute the great bulk of the product.

The several products of coal tar are thus used in the arts:—

Coal tar is itself employed as a rough varnish for iron, and in Scotland the *boiled tar* is extensively used for covering woodwork, &c.

Light oil and crude naphtha are either redistilled for procuring benzole and toluole, as I have already explained, or they are employed for making common black varnish, or for burning in naphtha lamps. In this country they are for the most part distilled, but in Scotland they are largely used in a lamp called the *foundry lamp*. It is an enlarged form of a lamp which was patented many years ago by Mr. Beale, and it consists of a chamber supplied with naphtha, and having a nozzle or jet for directing a blast of air through it. The chamber is covered with a bell with a large hole in the top of it. When the naphtha is lighted and the bell put upon it, the blast of air forces the vapour of the burning naphtha through the hole in the top of the bell, and thus produces an enormously large volume of flame. The light is equal to at least a dozen gas-jets, and the cost of it is said to be a penny a night. It is very generally used in the foundries, the ship yards, and other large workshops of Scotland.

Solvent naphtha is a colourless spirit which is chiefly employed for dissolving india-rubber for waterproofing, and resins or pitch for varnishes.

The *last runnings* are also used for varnishes, for making a superior lamp black called *spirit black*, and for burning in Holliday's lamp, which is the common naphtha lamp of the streets. It is an ingenious contrivance for converting the naphtha into vapour by means of a mass of heated metal and spreading it out in a star-like form.

I have already alluded to the use of coal naphtha as a means of increasing the illuminating power of common 12 or 14 candle gas, and have shown that with a moderately good naphtha, which yields about seven grains of vapour to every cubic foot of gas, the illuminating power may be increased about 60 per cent. Considering that

naphtha is now becoming a drug in the market, from the waning of fashion in respect of coal-tar colours, it may be worth while to encourage its use as a naphthaliser, rather than to yield to the public clamour for cannel gas. I have long thought that gas, as well as water, should be dealt with at the consumers' houses, when in either case it is required to be of unusual quality.

The creosote, or dead oil of coal-tar, is used almost entirely for the preservation of timber, and at the present moment, in the stagnant condition of railway business, it is almost unsaleable. I apprehend, however, that it is valuable as a fuel, and that it will ere long be used in steam furnaces. Already there are several patents for its application in this manner, and experiments are now being conducted at Woolwich with the view of ascertaining its practical and economical capabilities. The contrivances which appear to offer the largest prospects of success, are those which deliver the oil into the furnace in the form of a spray or vapour, by means of a jet of steam or blast of hot air; and it is said that the heating power of the oil is from 2½ to 3 times that of a similar weight of coal.

In applying the oil to the preservation of timber, it is necessary that it should be forced deeply into the tissue of the wood, The method employed by the best operators is to place the timber in large wrought-iron cylinders, and then to exhaust it of air and moisture as completely as possible by creating a vacuum. After a time the dead oil, heated to a temperature of 120° Fahr., and thus made as fluid as possible, is let into the cylinder. Pressure is then put upon it until the oil is forced into the wood with a power of 150 lbs. upon the inch. In about three hours the wood absorbs the prescribed amount of creosote, which, with the best houses, is never less than from 30 lbs. to 50 lbs. of creosote to a load of 50 cubic feet of timber; every cubic foot of timber has, therefore, taken up from 6 lbs. to 10 lbs. of oil.

The preservative power of the dead oil is partly due to the antiseptic properties of the creosote, and partly to its filling up the pores of the wood with an oil which gradually resinifies and excludes air and moisture. Different views are entertained of the quality of creosote which is best suited for this purpose. In the contracts which I have prepared for the Indian railway works, I have prescribed that the creosote should have the following properties:—"It should have a density between 1,045 and 1,055; it should not deposit any crystalline matter at a temperature of 40° Fahr.; it should yield not less than 5 per cent. of crude carbolic acid to a solution of caustic potash of the density of 1,070 (14° Twaddle); and it should furnish 90 per cent of liquid oil when distilled to the temperature of 600° Fahr." The contracts, which I have lately seen, for the Dutch Government, prescribe that the creosote shall be clear, and shall not deposit more than 40 per cent of naphthaline when cooled to the temperature of 32°, and kept at that temperature for 24 hours. Here are specimens of creosote from country tar which fully realise those properties; but this sample from London tar is almost solid at 32°.

Another use to which dead oil has lately been put is the preparation of a dip for washing sheep. It was patented by Mr. M'Dougall in 1860, and is made by heating together two parts by weight of dead oil with one of a solution of caustic soda of 50° Twaddle (sp. gr. 1,250), which contains about 15 per cent of soda; and to this is added one part of tallow, fat, or other saponifiable substance. The mixture which is thus obtained has the appearance of a very dark soft soap, and it is either smeared upon the skin of the animal, or dissolved in water and used as a wash.

The *greasy matter, or green oil*, which follows the dead oil in the distillation of coal tar, is used for making railway grease, with resin, oil, &c.; and the pitch which is the residual product of the distillation is largely employed for all sorts of purposes.

(To be continued.)

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Group V.—Class 44: Chemical and Pharmaceutical Products.—Numbered 7 in the English catalogue (8 in the *Catalogue Général*), we find "Borwick, George, 34, Chiswell Street, London. Baking powder, chemicals, spices, &c.," and we are also referred to p. 132 of the appendix for further details. What can induce anyone to exhibit baking powder we are really at a loss to imagine. It certainly is not a subject of any scientific interest, it is not a novelty, it is not interesting in appearance; its mere physical character offers no guarantee of its purity, and, in fact, its negative qualities preponderate so largely, that positively we are astonished that its exhibitor did not (like a great firm of blacking manufacturers) obtain a medal. And yet this baking powder, so insignificant in appearance, so uninteresting in a scientific point of view, so unfit, therefore, for exhibition, is, measured by a commercial standard, of far more importance than many objects that rivet our attention by their beauty or scientific interest. We have been credibly informed that a fortune has been made by its sale.

Then what is this baking powder out of which fortunes have been, or are to be made? Of the composition of the powder of Borwick we know nothing, but Cooley's powder is as follows:—Tartaric acid, ½ lb.; bicarbonate of soda and potato farina, or British arrow-root, of each ¾ lb. (each in powder); separately dry them *perfectly* by a very gentle heat, then mix them in a dry room, press the mixture through a sieve, and at once put into packets, observing to press it hard, and to cover it with the foil or close-made paper, to preserve it as much as possible from the air and moisture. Delfort's formula principally differs in the addition of *alum!* and carbonate of ammonium. With the addition of a little turmeric the compound becomes the "Egg powder" so often seen in the windows of grocers and oil-men. These mixtures are used in domestic economy as substitutes for yeast in bread and butter in pastry, and are in their way, and in their proper places, useful, although humble adjuncts to the *materia* (may we not say *medica*), of the non-professional cook. There is no doubt that by enabling pastry to be made equally light, and with one-third less butter, the better class of baking-powders have prevented many a bilious and dyspeptic attack.

Mr. Borwick, in addition to his baking-powders, exhibits what he terms "ozonized cod-liver oil." We are sorry to find cod-liver oil "repeating" itself in our notices of the chemical and pharmaceutical products in the French Exhibition, but we will not prevent the unsavoury nature of the subject to turn us from our duty. We consider "ozonized cod-liver oil" to be the greatest of the many delusions connected with this useful food—for food it is purely and simply, and the sooner medical men understand its true character the better for their patients.

Mr. Borwick's prospectus states that the impregnation of cod-liver oil with ozone is for the purpose of "conveying artificially to the lungs of the delicate and consumptive, without the effort of inhalation, and in larger proportions than found in the atmosphere, this extraordinary life-giving agent." The prospectus concludes with the following somewhat rash paragraph: "In fact, it is now proved beyond doubt, that ozone is to the weak, delicate, and consumptive, what quinine is to those who are affected with fever—*the nearest approach to a specific yet discovered*." The italics are those of Mr. Borwick.

Now, it appears to us that this prospectus has certain points of resemblance to the three incompatible pleas anent the cracked pot, viz.: "1st, that it was cracked when we borrowed it; 2nd, that it was whole when we returned it; 3rd, that we never had it at all." For, in the first place, a distinguished chemist who purchased some

and examined it, came to the conclusions—1st, that it did not convey ozone to the lungs of the delicate and consumptive; 2nd, that, if it did, it was not "to the weak, delicate, and consumptive, what quinine is to those who are affected with fever; and, 3rdly, that it did not contain ozone at all." It is really inconceivable how any one with even a smattering of chemical knowledge could imagine even if the oil *did* contain ozone that it would carry it to the lungs. The trifling fact that the oil has to be digested before it can enter the blood seems to escape the believers in this so-called remedy. That certain oils acquire powerfully oxidizing properties on exposure to light and air we admit, but it must be remembered that in all cases yet known the active oxygen attacks the *oil itself* as soon as the temperature is raised, and may even attack other oxidizable substances present at the same time. The most remarkable instance of the oxidization of essential oil, is, undoubtedly, that of isoprene*; but when ozonized isoprene is distilled (although it boils at about 40°C.) the ozone present attacks the isoprene with violence, and converts it into an oxidized substance. We think, moreover, with the observer of that reaction, that it is doubtful if the oxygen in what we have hitherto termed ozonized oils is really in the state of ozone. The phenomena attending the passage of ozone through tubes of caoutchouc seem to indicate the impossibility of ozone existing (as such) in the presence of oxidizable organic matters.

Even if we admit that consumptive patients are better in an atmosphere which indicates the presence of ozone (or what is assumed to be ozone) what does that really prove? It seems to us rather to show that consumptive people are better when the air is free from the impurities incompatible with the presence of ozone, than that the ozone itself is beneficial to them. The reaction indicated by ozone test papers is not the measure of the total quantity originally in the air, but of the residue left after the destruction of the impurities. But enough of this, we trust that the time is fast approaching when medical men will know more, and talk less, about oxygen and ozone. If one did not hear it so often, it would seem impossible, that in these days of education, doctors are still found who tell their patients to go to the sea-side, "where there is *more oxygen* than in the close and confined streets of towns."

The British Sea-weed Company (Limited) Whitecrook Chemical Works, Dalmuir, Glasgow, have an interesting collection illustrating Mr. Stanford's process of treating sea-weeds.

When sea-weed is incinerated in the usual way a great loss of iodine is experienced, amounting, it is said, to no less than half. Mr. Stanford, by distilling the weeds in iron retorts, entirely prevents this loss, and obtains, in addition to a valuable series of products of destructive distillation, a charcoal which, after lixiviation, is well adapted for the purposes for which animal charcoal is generally used. Indeed we are informed that the carefully prepared charcoal, from certain varieties of weed, actually exceed in bleaching power the best animal charcoal to be found in commerce. The extreme porosity of sea-weed charcoal is greatly in its favour for bleaching and deodorising, in fact, so readily does it allow even thick syrups to pass, that the filters seldom or never become clogged, if properly arranged. They exhibit three different kinds of this charcoal; No. 1 from "Tangle" is intended for sewage filtration and as a deodoriser; No. 2, from Bardarrie, is at present sold for bleaching; and No. 3, from Black Wrack, is proposed for sugar-refining.

The Company also exhibit iodine, bromine, and potash salts, the latter extracted from the charcoal remaining in the retorts after the distillation is finished. There is also sufficient nitrogen in the sea-weed to yield enough ammonia to figure as an element in the profits of the undertaking. Whether the oils and tar shown are of sufficient value to be of importance in a pecuniary point of view we are not aware. We should like to know whether a *thorough* scientific examination of the acid, basic, and neutral products of the destructive distillation of sea-weed has yet been made, as it would be very interesting to compare them with those from wood coal and especially peat.

It is highly satisfactory to find that the process which was considered by the jurors of the Exhibition of 1862 as sufficiently hopeful and ingenious to deserve a medal, is now carried to a successful issue under the superintendence of its inventor.

* Phil. Trans. 1860.

REPORTS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

A COURSE OF FOUR LECTURES ON

SPECTRUM ANALYSIS,

WITH ITS APPLICATIONS TO ASTRONOMY.

By WILLIAM ALLEN MILLER, M.D., F.R.S., &c.

Lecture IV.

Spectra of the Fixed Stars.—Mode of observation.—Double Stars.—Variable Stars.—Temporary Bright Star in Corona.—Nebulæ.—Clusters.—General Conclusions.

In the last lecture I gave you some account of the solar spectrum, and stated some of the principal facts which were revealed to us by its examination. You will remember that in the solar spectrum there are a great number of lines produced, as we now know, by absorptive action in an atmosphere which surrounds the more intensely luminous portion of the sun. We have learned to interpret many of these lines, and we have found that in a great number of cases they are produced by the presence of elementary bodies, known to us upon the earth, which, in the gaseous state, exert an absorptive action upon certain parts of the sun's rays. We have learned, also, that there are certain bodies which are not present in the sun—among them gold, silver, lithium, and several others. But there are still a great number of lines of the nature of which we know nothing. Many, no doubt, will be explained as we proceed further with our investigations into the spectra of terrestrial elementary bodies. Notwithstanding the efforts that have been made within the last few years, our knowledge of terrestrial spectra can be at present considered to be only in its infancy. We can not know what elements, indeed, are still existent upon the earth. We can not be supposed to have come to the end of our knowledge upon this point, for within the last five years no fewer than four of these elementary substances have been discovered by the simple application of this method of spectrum analysis.

The investigation of the solar spectrum, difficult as it is, is one considerably favoured by certain circumstances. We are not limited by season, or the angular altitude of the sun, but can pursue the investigation whenever the sun shines. Moreover, we can command any amount of light which the eye can bear. We can, therefore, by the action of an almost unlimited series of prisms, dissect and open out that solar spectrum, and so scrutinise, with minute accuracy, the position and character of every line which it contains.

I have to-day to refer to other sources of light which may be analysed in a similar way, but the study of which presents difficulties of no ordinary character. I propose to explain some of the methods which have been adopted for the examination of stellar spectra, and to state the chief results obtained by that examination, and I shall conclude by giving you some account of the remarkable and unexpected results obtained by a study of some other still fainter objects which are visible in the heavens—the nebulæ.

It may be necessary for me to give you some notion of the kind of difficulties with which we have to contend in these enquiries, in order to explain how it is that the results, important as they are, are still very imperfect. Solar light, as I have said, may be obtained in unlimited quantity; but when we examine the spectra of the stars we have to deal with points of light. We must collect the light, therefore, and for that purpose either a large reflector or refractor is necessary. Cumbrous machinery is required for moving the tube to enable it to follow the motions of the star, which is apparently perpetually shifting its place in the heavens. We have to bring this light to a point by means of our lenses. The more accurate our telescopes the more exactly is this light brought to a mathematical point. Now, if we attempt to analyse by means of a prism a point of light like this, we shall spread it out into a line, but that line will be so exceedingly narrow that we shall not be able to trace across it the lines of which we are in search, and which are to speak to us of its nature. The first thing, therefore, we have to do, after we have obtained our point of light, is to open it out into a line. That may be done, as was practised by Fraunhofer, by means of what is known as a *cylindrical* lens. I shall endeavour to throw upon the screen a little point of light, which you may, if you please, for a moment consider to be a star, and will then elongate its image into a line of light.

[A circular spot of light was projected upon the screen, and then by means of a cylindrical lens expanded into a line of light.]

Though I can imitate a star in the exceeding minuteness of its light, I, unfortunately, cannot imitate it in the quality of its light, and, therefore, on this occasion, I shall not be able to show you the spectra themselves, but I shall have recourse to photographs from careful drawings made upon the observations of the stellar spectra. In the observations from which these drawings were made an achromatic object glass of eight inches aperture was used, and the observations were made at the observatory of Mr. Huggins, at Tulse Hill, where he and I worked together for some years upon stellar and planetary spectra, and where he has since still further added to our knowledge by his examination of the nebulæ.

Having obtained our line of light, the next thing is to project it upon a suitable instrument for making the observations, and this line of light must be kept absolutely steady at the end of a tube ten feet long, upon a slit, the width of which is not more than the 300th part of an inch, or much finer than any ordinary hair. Obviously this can be obtained only by an exceedingly smooth motion maintained by the clock movement of the telescope.

Here is a star spectroscope in the form which, after many trials, we found to be most convenient for these observations. I am indebted to the kindness of Messrs. Simms for the loan of this beautiful instrument, which they are going to send to Professor Cooke, in America. I am also indebted to Mr. Browning for the opportunity of showing you another instrument intended for Mr. De la Rue, which is, in some respects, even better for our purpose, because it enables us to see the parts of which it is composed. This instrument of Messrs. Simms is provided with shutters, so as to exclude dust and other sources of injury to the prisms within. When in use the spectroscope is attached to the eye-end of the telescope, instead of the ordinary magnifying power, and will be carried round with it, accurately following all its motions. The cylindrical lens is placed between the object-glass and the slit, so that the light, instead of falling upon the slit as a point, shall fall upon it as a line, such as I just now showed you, only much more definite than the line which was projected upon the screen. The line of light having fallen upon that slit, is then passed through an apparatus precisely similar in principle to the spectroscope which we examined in the last lecture.

The light of the star is brought to a focus by the action of the object-glass of the telescope itself, exactly at the spot occupied by the slit of the instrument. But before reaching that spot, it passes through the cylindrical lens, by means of which it is spread out into a line, instead of a point. After passing through the slit, the light falls upon a collimating lens—that is to say, upon a lens the object of which is to bring all the rays that fall upon it into a parallel direction. The rays rendered parallel next fall upon a couple of prisms—the first prism dispersing the light to a certain extent, and the second dispersing it still farther, and producing a spectrum of the star, the most refrangible end being that which is most turned from the original direction. The spectrum then falls upon the lens of a small telescope, by means of which the image can be viewed at the proper distance. The object of the screw beneath the tube is to enable us, by a regulated movement, to carry round the small telescope, so that each part of the spectrum can be successively examined. There are cross wires in the telescope, so that, on bringing any of the lines in the star spectrum one after the other upon the cross wires by the micrometer screw, the distance between the lines may be measured exactly.

The object which we had in view in these investigations was not merely to ascertain that the lines existed in the stellar spectra, for that had been done by Fraunhofer, Donati, Secchi, and others, but to determine what these lines represented—to ascertain the constituents of the stars if possible; and that could be done, approximately at least, by measuring the position of each of these lines, and then comparing it with a map in which the lines of certain metals had been laid down, these metals having been examined by the same instrument as that which was to be applied to the stars. This, however, although it would give a result which was very valuable to us as suggesting what probability there was that certain metals were present in these stars, did not give us that absolute certainty respecting the nature of the substances which it seemed it was possible to attain by another mode of experimenting. That mode consisted in reflecting into the instrument the light produced by a series of electric sparks sent through wires of different metals in succession. In order to attain this object we have attached to this instrument a means of producing sparks between two points of silver. The instant that this circuit is included between the terminals of the secondary wire of an induction coil, a torrent of electric sparks passes between the two silver points. The light is reflected from a mirror, by which it is thrown, through an opening in the side of the tube, upon a little prism which acts as a reflector, and sends the light through the slit into the spectroscope for examination. In this way various stars can be submitted to experiment, but it is obvious that even here, although we have at command a large instrument, we are limited by the brightness of the stars. We cannot examine with any degree of precision stars which are below a certain magnitude, the quantity of light being too small. I shall endeavour to show you the results of the most accurate observations we have been enabled to make. Amongst these stars there are two in particular which are of special interest. These two are Aldebaran, the bright, reddish star in Taurus, and α Orionis, or Betelgeux, the principal star in Orion. Here is a list in which are mentioned certain elementary substances, all of which have been found to produce lines coincident with certain lines in this star Aldebaran:—

Sodium,	Bismuth,
Iron,	Antimony,
Magnesium,	Tellurium,
Hydrogen,	Mercury.
Calcium,	

There is not merely the coincidence of a single line in each case, for that might be an accidental circumstance, but the principal bright lines in each spectrum produced by these bodies have corresponding black lines in the spectrum of this star. You see that there are here nine of the substances known to us upon the earth. By similar means we ascertained the absence of certain other bodies;

these have no coincident lines in the star spectrum. Among these are nitrogen, tin, lead, cadmium, lithium, cobalt, and barium. We have ascertained not simply what are there, but what may not be there. Of the lines which are contained in this star we measured no fewer than seventy, notwithstanding the faintness of the object. Actual measurement, however, is possible only with a certain number of lines. There are an indefinitely greater number of lines existing in the spectrum of the star, many of which might possibly be measured by the devotion of still more time and application.

These observations are excessively fatiguing to the eye, and require special conditions of the atmosphere. A clear night, which would be very favourable to observations made simply with the telescope, might not be suitable for observations with the spectroscope. The slightest flicker or tremor in the atmosphere disturbs the accuracy of the observation. It must be remembered that we are not observing approximative coincidences, but we are desiring to observe absolute coincidences—coincidences between the bright lines of the metals we have on the earth and the black lines in the spectrum of the star.

In α Orionis we measured eighty lines, and amongst these we find that six of the metals of the earth had lines coincident with those in this star, viz.:—sodium, iron, magnesium, calcium, bismuth, and thallium (?), and that a still larger number were not coincident.

I shall project upon the screen a representation of the spectra of these two stars. They will both be visible together. The upper spectrum is that of the star in Orion, the lower one that of Aldebaran.

Beneath each diagram a number of bright lines may be seen. These represent the bright lines produced by causing sparks to pass between points of different metals attached to the coil. For example, here we have a line marked Sn. This is one of the lines indicating tin, but it has no corresponding line in the star, though we were able to measure within 5000th of an inch, or the 1800th part of the length of the entire spectrum, the coincidence between two lines. Here are the three lines of magnesium which have corresponding lines in the spectrum of this star. Here is the double line D in the sodium spectrum. That is a bright double line corresponding perfectly with two black lines in the star. Sodium is one of the most widely diffused substances in the stars; magnesium and iron are also present in both these stars. The lines in this photograph only extend to a certain distance into the blue. Here is the line *b*, and this is the line F, which is upon the margin between the green and blue. Note in passing that there is no line corresponding to F in the star α Orionis. There is a strong line corresponding to it in Aldebaran, but no line in the other. This line F is one of those due to hydrogen. I carry you to another—near the end of the red. Now this line in the spectrum of Aldebaran is a marked line corresponding with Fraunhofer's solar line C. That line also occurs in the spectrum of hydrogen. There are three lines in the spectrum of hydrogen—C, F, and G; but the point of interest here is that none of these lines are present in the star α Orionis, and we conclude that there is no hydrogen there. Besides these are a large number of other lines, some of which are interpreted, others still await interpretation.

We are not yet able to explain in the case of these stars, any more than in that of the sun, what every line indicates. It may very well be that many of these lines are caused by substances which are known to us, but of the spectra of which we are still ignorant; in other cases it may well be that they are produced by substances which are not know to us, and which have no existence, indeed, upon our planet. Amongst the substances which are present in the atmosphere of these stars, are some which are present in our own sun. In other instances, as in the case of bismuth, metals are found in these stars which furnish lines which are not present in the atmosphere of the sun. Both in Aldebaran and in α Orionis there are lines corresponding with those of bismuth. Tellurium appears to be an important element in the absorbent atmosphere round Aldebaran. Then there are also in the atmosphere of this star substances such as antimony and mercury, which we consider to be poisons. Here is the bismuth spectrum thrown upon the screen. Though not so striking as that of some other metals, its characters are sufficiently strong to enable us to pronounce with certainty upon the presence or absence of lines corresponding with this substance in any star with which its spectrum is compared.

(To be continued.)

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Absorption of Carbonic Acid by Oxides.—J. Kolb finds that the anhydrous and monohydrated oxides of potassium, sodium, magnesium and barium, like calcic oxide, do not increase in weight when exposed to dry carbonic anhydride, but absorption takes place if the latter is charged with moisture. —(*Comptes, R.* lxiv. 861.)

Ozone, Density of.—T. L. Soret. Having previously found that the density of ozone is 1½ times as great as oxygen, the author now applies the method of diffusion as a control of his former observations.

Under similar conditions, in one case, a known mixture of chlorine and oxygen, in another a known mixture of ozone and oxygen were diffused into pure oxygen. The velocity with which chlorine and ozone passed through the diaphragm was in the ratio:—

Chlorine .. $\frac{227}{271} = 8382$
Ozone ..

This value approaches closely that of the inversed proportions of the square-roots of their respective densities, taking that of ozone as 1½ that of oxygen, *i.e.* =·8243.—*Comptes R.* lxiv. 904.

Pseudo-hexylurea. — T. T. Chydenius. This compound is prepared by heating pseudo-hexylic iodide (obtained from mannite) with argentic cyanate to 50°—60° C. The reaction is violent, and a liquid strongly affecting the eyes, and possessing a very disagreeable odour, distils over. An excess of ammonia is added, and the solid mass, thus formed, recrystallised from water. Pseudo-hexylurea crystallises in white needles which are readily soluble in hot water, ether, and alcohol, melt at 127° C., and boil, with partial decomposition, at 220°. Its formula is:

$$N_2\begin{cases} CO \\ (C_6H_{12},H)H \\ H_2 \end{cases}$$

When heated with a strong aqueous solution of potassic hydrate in sealed tubes, decomposition sets in at 230°—250°, ammonia being given off, and an oily liquid formed, which probably is isopropylamine.—(*Comptes. R.* lxiv. 975.)

Nitriles, action on Bromine of.—C. Engler. Propionitrile and bromine combine when heated together, forming bromhydrate of propionitrile, $NC_3H_4B_2HB_2$. The body is very deliquescent, fuses at 64° C. and begins to sublime, with partial decomposition, at 72°. It will be seen that bromine in this case acts differently from chlorine, the latter producing, as is well known, dichlorpropionitrile, $NC_3H_3Cl_2$. Water decomposes the bromhydrate to bromammonium, bromhydric acid, and a new body which is dimonobrompropionamid.

$$N\begin{cases} C_3H_4BrO \\ C_3H_4BrO \\ H \end{cases}$$

This latter compound is obtained in white crystals which are soluble in alcohol and ether, almost insoluble in cold water, fuse at 148° C., and decompose at 152°. Aqueous potassic hydrate decomposes the amide wi-

formation of a new acid, the argentic salt of which has the composition $C_5H_9AgO_3$. Dimonobrombutyramide, $N(C_4H_6BrO)_2H$, is prepared in the same way as the propyle-compound, which it resembles closely.—(*Ann. Chem. Pharm.* cxlii. 65.)

Trichlorhydrin, Action of Ammonia on.—C. Engier. Dimonochlorallylamine

$$N\begin{cases} C_3H_4Cl \\ C_3H_4Cl \\ H \end{cases}$$

is formed by digesting trichlorhydrin with alcoholic ammonia under pressure at 130°—140°C. It is a heavy oil, sparingly soluble in water, soluble in alcohol and ether; it decomposes partially on distillation, the portion, analysed, went over between 185° and 195°. The salts of this base are deliquescent, and difficult to obtain in crystals from an aqueous solution. The platino-chloride is readily soluble in water, moderately so in alcohol, and nearly insoluble in ether. It has the composition $N(C_3H_4Cl)2H_2Cl,PtCl_2$.

An ethyl-substitution-compound of dimonochlorallylamine is obtained by heating the latter with ethylic iodide in sealed tubes to 100°C. Its composition is

$$N\begin{cases} C_3H_4Cl \\ C_3H_4Cl \\ C_2H_5 \end{cases}$$

It differs but little from the original compound.—(*Ann. Chem. Phar.*, cxii., 77.

Analysis of Organic Compounds, New Method of.—A. Mitscherlich. Of this new method of analysis, which is applicable to all organic, and many inorganic compounds, and which includes the direct determination of oxygen, we can only indicate the principle, as it would be impossible in these few lines to give, without pictorial illustrations, an intelligible description of the complicated apparatus and manipulations required.

1. Oxygen and hydrogen are determined together by heating the substance in a current of chlorine, passing the products of combustion over red-hot charcoal, and absorbing the chlorhydric acid, carbonic anhydride, and carbonic oxide formed by a saturated solution of plumbic nitrate, a solution of potassic hydrate, and a solution of cuprous chloride in chlorhydric acid respectively.

2. Chlorine, bromine, iodine, and sulphur are determined simultaneously with carbon and nitrogen, by volatilising the substance in a current of hydrogen, burning the mixed gases and vapours with oxygen, removing the water by means of sulphuric acid, and collecting the products of combustion in weighed vessels—with the exception of nitrogen, which is measured. The products of combustion, besides the water, may consist of carbonic anhydride, chlorhydride acid, bromine, iodine, sulphurous acid, sulphuric acid, and traces of brom- and chlorhydric acid. A residue of carbon also may be left in the combustion-tube. The water is absorbed by sulphuric acid, the chlorhydric acid by plumbic nitrate, bromine by mercuric oxide, iodine is weighed as such, sulphurous acid is absorbed by potassic bichromate, carbonic anhydride by potassic hydrate, nitrogen is measured, and the residual carbon weighed.

The specimens of analysis given, prove that very accurate results may be obtained by this new method.—(*Pogg. Ann.* cxxx. 536.)

Qualitative Analysis without using Sulphuretted Hydrogen and Ammonic Sulphide.—E. Zettnow. The author tests an aqueous solution, which may contain all of the more common bases, with the following reagents in succession:—

1. Chlorhydric acid precipitates lead, mercury, and silver.

2. Sulphuric acid precipitates lead, barium, strontium, and calcium.

3. Baric hydrate sets free ammonia, the filtrate is used for the detection of sodium and potassium.

4. Zinc is added to the filtrate from 2, the hydrogen ignited and tested for antimony and arsenic; antimony, arsenic, tin, mercury, copper, cadmium, and bismuth are precipitated.

5. Baric carbonate precipitates from the filtrate from 4, iron, chromium, and aluminium.

6. Ammonic carbonate, after removal of the baryta, precipitates from the filtrate of 5, manganese and calcium; the filtrate is tested for magnesium, cobalt, and nickel.

7. Zinc is tested for in the original solution.—(*Pogg. Ann.* cxxx. 324).

Reagent for Nitric Acid.—C. D. Braun. A very delicate test for nitric acid is, according to C. D. Braun, anilinic sulphate. Half a c.c. of a solution of the aniline-salt is added to one c.c. of pure, strong sulphuric-acid, contained in a watch-glass. A glass-rod is then moistened with the liquid to be tested, and moved about in the aniline mixture, when a red coloration indicates the presence of nitric acid.—(*Zeit. Analyt.* ch. vi. 71.)

CORRESPONDENCE.

VAPOUR DENSITY OF WATER.

To the Editor of the Chemical News.

Sir,—I have read with much interest the five communications called forth by some remarks on the vapour density of water, extracted by you from a letter of mine to a private friend.

It is curious to note the little discrepancies which occur in the computations of so many able and learned men applying their minds to the same subject.

On one point the five letters supply these different figures:—

·80424 ·80475 ·8056 ·8064,

of which the last-named has the support of the majority, and is the figure at which I had previously arrived.

On another point I gather these figures:—

1239·9 1240·6 1241·3 1242·6 1243·4—

my own figure, independently calculated, being 1240.

On the question of the true gas-expansion ratio, touched by one of your correspondents, and lying at the very root of the matter, I happen to have a paper at hand, giving the results arrived at by several eminent authorities, and showing notable discrepancies between them, even as to this fundamental *datum*. These ratios are as follows, for the volume at zero F.:—

Dalton and Gay Lussac	$\frac{1}{2\,1\,8}$
Regnault	$\frac{1}{2\,1\,8}$
Magnus	$\frac{1}{2\,1\,9}$
Rudberg	$\frac{1}{2\,1\,7}$

Correcting these ratios for the volume at freezing-point, they become:—

Dalton and Gay Lussac	$\frac{1}{2\,6\,0}$
Regnault	$\frac{1}{2\,6\,0}$
Magnus	$\frac{1}{2\,6\,1}$
Rudberg	$\frac{1}{2\,5\,9}$

Applying the first and last of these ratios to the question in hand, and taking $\frac{1000}{·8064} = 1240$ as the standard for comparison (my own computation whereof is sanctioned by the majority of your correspondents), we have, according to Dalton and Gay Lussac—

$$\frac{480}{660} \times 1696 = 1233·45$$

and, according to Rudberg:—

$$\frac{494}{674} \times 1696 = 1243·06$$

On comparing each of these results with our above-mentioned standard, deduced from the volumetric composition of water, we obtain, as the respective discrepancies, *the values* 6·55 and 3·06; the former being *below* and the latter *above* the standard; so that the discrepancy between the two results themselves is the sum of the amounts above stated, viz., 6·55+3·06=9·61.

Neither of these discrepancies, however, is so large as that worked out by me in my last letter—into which, I must own, that error crept, through my using (in the absence of my books of reference) an imperfectly remembered rule of computation.

If lastly, we work out the calculation as before, substituting Regnault's ratio, we obtain

$$\frac{490}{670} \times 1696 = 1240{\cdot}3582$$

which differs from the standard by only

0·3582.

The question therefore turns, so far as the greater or less discrepancy is concerned, upon the relative merits of the respective determinations, by the eminent authorities quoted, of the expansion ratio for gases: as also, upon the more or less thorough soundness of the laws laid down as governing the expansion of gases, one or two of which laws, if I remember rightly, rest partly on assumption.

Meanwhile, though we are free to regard the discrepancy under consideration as larger or smaller, according to the expansion ratio on which we elect to rely, science as yet affords no absolutely certain proof, entitling any one to deny its existence.

The observed and calculated vapour-densities of many other bodies, besides water, show also (unless my memory betrays me) fractional differences more or less important, the very smallest of which may have a real existence, and may exercise more influence than is yet suspected on the play of chemical phenomena. This was the special consideration I addressed to my friend—supporting it by an example drawn from water, and an analogy supplied by music. In the carelessness of intimate pen-talk, I inadvertently made out the discrepancy cited too great; and this, not only as regards the fact itself, but also as regards the fitness of the illustration to my argument. For I was really referring to minute, not considerable differences; and my example is rendered all the more apposite by the correction now supplied.

The want of symmetry established, by Stas, in the ponderal relations of matter, lends colour, I think, to the hypothesis, that a like condition may attend its cognate volumetric proportionalities; for, that these relations should be all absolutely integral, while so many of the others are fractional, seems to me a somewhat hazardous assumption.

In these musings, however, I carefully avoid affirmation; I merely ponder and surmise. Such unripe germs of thought are fitter, no doubt, for the commerce of friends than for the wider public audience, which accident has, in this instance, afforded to mine. If your favour, Sir, have, as I fear, given them more prominence than they deserve, I can only hope that, by stimulating thought, or, still better, by suggesting experiment, they may pay for the time and space they have occupied.

To your able correspondents, whose courteous indications have afforded me much light, I beg, in conclusion, to offer my best acknowledgements, and I remain, &c.,

F. O. Ward.

North Wales, July 20th, 1867.

MISCELLANEOUS.

The Water we Drink.—The Registrar-General in his weekly report says, that on the intermittent system of supplying, the pipes are often left empty, and in that case sometimes get saturated with impurities. This happened in Portland-road, where analysis detected sewage contamination in the water drawn from the stand pipe on June 1st: the sewage was equivalent to 1 per cent of the water, which was turbid when drawn, and, after standing a few days, emitted an offensive odour, and threw down flocculent matter.

University of London.—Science Examination.—Results.—First B. Sc.—1st Division: Bottomley, Carey, Gum, Harding, Hopkinson, Robinson, Tilden, Wormell.

2nd Division: Ball, Brice, Bright, Graham, Leonard, Pearsall, Sheldon, Thorp, Whipple.

Second B.Sc.—1st Division: Exall, W. H. (King's College); Payne, J. F. (St. George's Hospital); Smith, R. S. (King's College).

2nd Division: Duer, S. (private study); Ridge, J. J. (St. Thomas' Hospital); Robinson, E. (Owen's College); Sprengell, J. C. F. L. (private study); Waller, A., B.A. (St, Thomas' Hospital); Wigner, J. M. (private study).

Honours.—Exall, W. H., second class; Chemistry.

Prel. Scient. M.B.—1st Division: Aveling, Ball, Barff, Bruce, Burn, Carter, C.H., Elkington, Gibbings, Harris, J. A., Harris, M., Haynes, Hunt, Saunders, Wall.

2nd Division: Bindley, Burgess, Carr, Carter, A. H., Cotterill, Coupland, Cross, De Mèric, Edwards, Fox, T. C., Franklin, Graham, Herman, Ingoldley, Jones, T., Lowe, Lyell, Male, Paget, Perkins, Pippette, Puglie, Ralli, Rayner, Rowland, Rugg, Simon, Sloman, Smith, Southee, Taunton, Waddy, Willaus, Williams.

Experiments on the Poison of the Cobra-di-capella.—The *Melbourne Argus*, for April 26th, contains an interesting article, by Dr. G. B. Halford, on the above subject, from which we extract the following:—"The melancholy accident which so lately happened with the cobra-di-capella induced me to make some experiments and observations upon the action of the reptile's poison. When a person is mortally bitten by the cobra-di-capella, molecules of living 'germinal' matter are thrown into the blood, and speedily grow into cells, and as rapidly multiply; so that, in a few hours, millions upon millions are produced at the expense, as far as I can at present see, of the oxygen absorbed into the blood during inspiration; hence the gradual decrease and ultimate extinction of combustion and chemical change in every other part of the body, followed by coldness, sleepiness, insensibility, slow breathing, and death. The cells which thus render in so short a time the blood unfit to support life are circular, with a diameter on the average of one seventeen-hundredth of an inch. They contain a nearly round nucleus of one two thousand-eight-hundredth of an inch in breadth, which, when further magnified, is seen to contain other still more minute spherules of living 'germinal' matter. In addition to this, the application of magenta reveals a minute coloured spot at some part of the circumference of the cell. This, besides its size, distinguishes it from the white pus or lymph corpuscle. Thus, then, it would seem that, as the vegetable cell requires for its growth inorganic food and the liberation of oxygen, so the animal cell requires for its growth organic food and the absorption of oxygen. Its food is present in the blood, and it meets the oxygen in the lungs; thus, the whole blood becomes disorganised, and nothing is found after death but dark fluid blood, the fluidity indicating its loss of fibrine, the dark colour its want of oxygen, which it readily absorbs on exposure after death. It results, then, that a person dies slowly asphyxiated by deprivation of oxygen, in whatever other way the poison may also act, and so far as the ordinary examination of the blood goes, the *post-mortem* appearances are similar to those seen after drowning and suffocation. I have many reasons for believing that the *materies morbi* of cholera is a nearly allied animal poison. I hope also to show the presence of the poison of our snakes in the blood of bitten and inoculated animals, and to make some experiments on the possibillty of saving life.

Behaviour of Manganese with Chlorate of Potash before the Blowpipe.—If chlorate of potash be heated by means of a blowpipe, in a tube closed at one end till oxygen is evolved, and then a trace of manganese added, the potash salt will assume a purple colour. owing to the production of permanganate of potash, This reaction of manganese is quite as delicate as the one proposed by Berzelius.—*T. Landauer.*

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Comptes Rendus. April 15 & 22, 1867.

H. Fizeau "New Observations on Iodide of Silver."—A. Secchi "Note on the Spectra of the Stars." "On the Transparency of Red-hot Iron."—V. Louguinine "Action of certain Substances having a powerful Affinity for water on some aromatic Aldehydes." Berthelot "Method for reducing and saturating Organic Compounds with Hydrogen."—Dusart "Preparation of Phenols." Tresca "On the flow of Solids under heavy Pressures."—T. S. Hunt "On the Formation of Gypsums and Magnesium Lime Stones."—P. Gauchler "Theoretical and practical Researches on the Flow and Motion of Water."—T. Richter "On Indium."—Berthelot "Method of reducing and saturating Organic Compounds with Hydrogen."—A. Perrot "On obtaining High Temperatures by the Combustion of a Mixture of Illuminating Gas and Air."

April 29.

Becquerel "On the Causes of Rain."—T. S. Hunt "Some Reactions of Magnesia Salts, and on Rocks containing Magnesia."—Coupvent des Bois "On the Determination of the South Magnetic Pole."—Naquet "On the Principles of Chemistry according to Modern Theories."—Chacornac "Resumé of a Memoir on the Solar System."—L. Cailletet "On a Process of Gilding and Silvering by means of Sodium Amalgam."—H. Deville "On the same Subject." L. Dusart "Contributions to the knowledge of Phenols."—J. Kolb "On the Absorption of Carbonic Acid by some Oxides."—P. P. Deherain "Experimental Researches on the Use of Potash Salts in Agriculture."—C. Mene "On Yellow and White Iron Pyrites."

May 6.

E. Carre "On some new Refrigerating Apparatus."—J. L. Soret "Researches on the Destiny of Ozone." (Second Part.)—F. P. Le Roux "On the Cause of the Undulations produced in Metallic Wires by the Electric Discharge."—E. Jungfleish "On some Points of Relation between the Melting Points, Densities, and Specific Volumes of some Chlorinated Derivatives of Benzene."

NOTES AND QUERIES.

Sulphate of Magnesia.—A subscriber wishes to know the name of a firm in the North of England who makes sulphate of magnesia by the process described in our journal of April 12th.

Origin of the word Naphtha.—Sir,—I have been trying to trace the origin of the word naphtha, but have not succeeded, Can any of your readers tell me where it was first used to designate an inflammable liquid coming out of the ground?—F. Peterson.

Papering Damp Walls.—Sir,—If your correspondent of last week, R. A., Dudley, will get some of the water-glass or soluble silicate of soda advertised in your columns, and brush the dilute solution several times over the damp wall, allowing it to soak in and dry between each application, he will effect a cure.—E.

Manufacture of Sulphuric Acid.—Sulphurous acid, in presence of much water, reduces binoxide of nitrogen to oxide of nitrogen. Can any of your readers kindly inform me what strength the chamber should work to prevent this. I am working two chambers connected. I should also be glad to know what quantity of nitrate of soda is required to make 20 cwt. of sulphuric acid sp. gr. 1750.—Child.

Plaster of Paris.—I should feel obliged to any of your correspondents who would inform me whether there is any way of causing plaster of Paris to set perfectly hard, so that it cannot be scratched by the finger-nail. I have tried the plan recommended in *Muspratt's Chemistry*, page 462, but do not find it to succeed.—A Working Potter.

Making Pyrogallic Acid.—Sir,—Will any one inform me whether a method has been published whereby pyrogallic acid can be made in the wet way from gallic acid. The process of sublimation usually adopted is tedious and uncertain. Some years ago a variety of pyrogallic acid in hard prismatic crystals was introduced in photography; this was evidently crystallised from an aqueous solution. Query—Was it sublimed first and crystallised afterwards, or was it not rather prepared in the wet way?—I. Couper.

Iron made Red-hot by Hammering.—Sir,—In answer to "Sceptic" (Chemical News for June 21st), I beg to state that it is a common thing for a good blacksmith to hammer a horse-shoe-nail red-hot upon a common anvil. I have seen it done by one Jesse Stubbs repeatedly, who informed me, that "years ago when he was a lad," it was not an uncommon thing for a journeyman blacksmith on applying for work, to have to prove himself a good hammerman by making a nail red-hot in as few a number of strokes as possible. I once produced a blacksmith and anvil at a lecture, before the Royal Literary Institution of Hull, when the man made the nail glow before the audience by hammering it. Old blacksmiths in the country say that, before the days of Congreve, Letchford, or Bryant and May, they many a time lighted their forge fire of a cold morning by means of a nail made red-hot by converting motion into heat, or as they term it, "a few sharpish taps" with a hammer. Let "Sceptic" go to a large blacksmith's shop and offer a shilling to every man who will hammer a nail red-hot, and unless blacksmiths have degenerated during the late severe winter, he will soon part with his money.—J. W.

Mercerising Cotton.—Sir,—There is no doubt that Mr. Mercer's discovery, mentioned in your number for July 12, is a valuable one, and were the objections to it more generally known, some of your talented readers might succeed in overcoming them. The advantages are that the fabric contracts about one-fifteenth linearly in each direction and the threads appear rounder, firmer, and closer together; the cloth does not reflect so much white light, but has a translucent appearance. Its strength is also improved; cotton thus treated shows a superior affinity for some colours, especially indigo blue; it takes as deep a shade of blue in one dip as common cloth takes in six, and, generally speaking, colours look better on this than on untreated cloth. The objection to the process was mainly the expense of the soda, but now that this agent has been reduced in price this objection will not be so formidable. It was also said that the appearance of greater fineness and closeness, produced by the contraction of the fibre, could be more surely and economically produced by the loom.—F. Oglevie.

ANSWERS TO CORRESPONDENTS.

Errata.—Page 15, line 16 from the top, *for* carbonate of soda, *read* carbonate of ammonia; page 27, line 2 from the bottom, *for* 1863, *read* 1836.

B. H. A.—Nitrite of amyl may be prepared by passing nitrous vapours into amylic alcohol contained in a heated retort, rectifying the distillate, and collecting apart the portion which goes over at 90 deg. C.

James P.—Your problem in hydrostatics fails in one important requisite: you have forgotten to allow for the force of gravitation.

A. L. S.—It would be a breach of confidence to impart the information, even if we possessed it.

Barium.—Your communication is declined with thanks.

Medicus.—One of the best hæmostatic agents is said to be a mixture of perchloride of iron and common salt, dissolved in water. No free acid must be present.

M. Kestner.—The best examination of the fixed line D of the solar spectrum was given with a diagram, by Professor Cooke, in our number for July 4, 1863. The drawing shows eight sharp lines, and a nebulous band between the two constituents of D.

Junior Student.—The diaphanometer is an instrument proposed and employed by Saussure for measuring the transparency of the air. Its action was very imperfect, and any variation in the acuteness of the observer's sight would vitiate its results.

A.B.—There is no danger. Push the heat as far as you can.

J. C. B.—If you doubt the statement, come and see the books at our office. Or, should you prefer it, a clerk shall call on you with the printer's delivery ticket for the number printed.

Zena.—Don't be misled, the book is a very good one.

W. Thomson.—Silver solder is best for uniting steel together. Make it by melting together 19 parts of silver, 1 part of copper, and 1 part of brass. Use borax as a flux.

C. Chase.—You had better consult a solicitor. We would rather not advise in such a case.

Dyer.—Stannate of soda is now generally employed. See if your sample contains tungstate of soda. The stannate contains 9 equivalents of water of crystallisation. It is efflorescent in a dry atmosphere.

Foreign Science.—Up to the time of going to press we have not received the Abbe Moigno's letter, nor the proceedings of the *Academie des Sciences* for Monday last.

D. Waldie.—Our correspondent's communication is received with thanks. We shall always be pleased to hear from him.

Communications have been received from J. Ilif; T. Sterry Hunt, F.R.S.; H. Burgoyne; L. Twining (with enclosure); A. S., Herschel; J. Ingram (with enclosure); J. Layton (with enclosure); C. Greville Williams, F.R.S.; Henry Woodward; F. Pright; C. R. C. Tichborne; J. N. Vinen; the Metropolitan Association of Medical Officers of Health; S. W. Moore; T. Landaner (with enclosure); George Lunge; C. Foster, B.A.; Ludwig Mond; W. M. Watts, B. Sc.; Dr. F. C. Calvert, F.R.S.; C. R. C. Tichborne; Gossage and Son (with enclosure); Jesse Fisher, do.; Benjamin Wheeler, do.; G. Eccles, do.; Smith and Sons, do.; J. Sampson, do.; J. Thom, do.; W. Blyth, do.; W. M'Leod, do.; H. Eve; C. R. A. Wright, B.Sc.; W. Kunde; F. Hughes; R. C. C. Lippincott; D. Waldie (Calcutta); J. D. Dana; Professor How, D.C.L.; Dr. August Stromeyer; F. O. Ward; Captain R. F. Burton (with enclosure); A. P. Hurlstone; S. Norman; Dr. P. Williams; B. Quaritch; J. Foord (Victoria); J. Thom (with enclosure); John Lundy.

Books Received: "Crystallogenic and Crystallographic Contributions," by James D. Dana.

*** **The Circulation of "The Chemical News."**—*Certain persons having been industriously spreading the report that the circulation of the* Chemical News *is only about one-third its real number, the Publisher takes this opportunity to inform advertisers that if they will favour him with a call at the office the books will be freely open to their inspection, and he will undertake to prove to their satisfaction that* the circulation of the Chemical News exceeds 2,000 copies weekly.

THE CHEMICAL NEWS.

Vol. XVI., No. 400.

NOTES ON SOME COMPOUNDS OF PALLADIUM.

By HENRY CROFT,
Professor of Chemistry, University, Toronto.

Palladio-bichloride of potassium is best prepared by passing chlorine through a concentrated hot solution of the palladio-protochloride. Almost the whole of the metal is precipitated as a double salt of a fine colour. What remains in solution may be advantageously employed in preparing the chloride of palladammonium.

The double salt $PdCl_2KCl$ exhibits a remarkable change of colour on the application of a moderate heat, turning quite black, and resuming its scarlet colour on cooling. If heated too strongly it fuses, loses chlorine, and, on cooling, is of a brown colour, being converted into the palladio-protochloride.

Cyanide of Palladammonium, originally described as ammoniated cyanide, is readily obtained by adding HCy to a solution of NH_3PdCl. It forms a white crystalline powder, soluble in hot water. Analysis showed it to be Fehling's salt.

Sulphide of Palladammonium.—When dilute $\left.\begin{matrix}H\\H\end{matrix}\right\}S$, or very dilute $\left.\begin{matrix}NH_4\\H\end{matrix}\right\}S$ is added to a solution of $NH_3\left.\begin{matrix}Pd\\Cl,\end{matrix}\right\}$ a bright red, or orange red precipitate is formed, much like the sulphide of antimony; it changes very rapidly into brown or brownish black sulphide of palladium.

Double Sulphocyanides.—These may be obtained in precisely the same manner as the platinum compounds described by Buckton. The potassium salt forms ruby-red crystals, which can be obtained of considerable size, soluble in water and alcohol. The latter solvent was used for separating it from the chloride. The salt is anhydrous, melts at a high temperature, gives off sulphur and bisulphide of carbon, and is oxidised by nitric acid, forming a white compound free from sulphur, apparently analogous to Claus's product. The solution of the potassium salt precipitates various metallic solutions, forming apparently corresponding insoluble palladio-sulphocyanides.

Similar compounds can be obtained from the palladio-protochloride. The potassium compound forms dark red needles. From the few analyses I was able to make, the composition of all the above salts seems to be the same as that of the platinum compounds.

By acting on the potassium salts with ammonia, a salt is obtained crystallising in fine reddish brown needles; the same can be obtained by acting on chloride of palladammonium with sulphocyanide of potassium in the same way as recommended by Buckton for the platinum salt. The analysis gave the formula $NH_3\left.\begin{matrix}Pd\\Cy\end{matrix}\right\}S$—sulphocyanide of palladammonium.

The sulphur is oxidised with great difficulty, even by hydrochloric acid and potassic chlorate.

Several compounds of palladammonium with organic acids, especially nitro-acids, are well crystallised, more particularly the trinitro-phenylate or carbazotate.

Petroleum as Fuel.—According to Adam's trials with petroleum for heating boilers, the following advantages, in comparison to coal, resulted:—Quicker steam generation, smaller dimensions of fire-place and boiler, constant firing, no smoke, ashes, or residua (these amount from 7 to 16 per cent when using coal); possibility of having an intense fire at once without the assistance of increased draught (this is of great importance to steam vessels); easier working, and considerably smaller store-rooms than coal would require.—*Revue Univers*, X. ann., livr., p. 206, with drawing.

ON THE MANUFACTURE OF NICKEL.

By DR. AUGUST STROMEYER.

The following communication concerning the production of nickel, will, no doubt, interest some of your readers. The method employed was kept a secret for a long time, and is partly so even now.

Formerly, nickel was produced from the speiss obtained in the making of smalt, but since the perfection attained in the manufacture of artificial ultramarine, smalt has not been so much in demand; less has therefore been made, and the old stores of speiss have been used up.

Recently some speiss has been produced from copper and silver ores containing nickel. These ores are smelted with pyrites, by which means the copper and silver are concentrated in the sulphide of iron. If the ore contains nickel in combination with arsenic (if not, arsenical pyrites is added), a bright heavy regulus composed of arsenic, nickel and cobalt, called speiss, will be found beneath the slag.

By an oxidising smelting, the speiss becomes purified, so that only arsenical nickel remains.

The speiss, in a pure state, has the composition Ni_3As (52 per cent of nickel); ordinarily, it contains iron, cobalt, bismuth, lead, antimony, and sulphur.

By smelting the speiss, or any nickel ore in contact with atmospheric air, and a reagent capable of fluxing the resulting oxide, pure arsenical nickel (Ni_4As) is obtained. The remaining separation of arsenic from the nickel is very difficult.

The following process for the production of nickel is that used at Dittenburg (Nassau). The ore is iron pyrites containing *capillary pyrites* (NiS), and occurs in veins of serpentine. Besides the nickel ore, a copper ore is also worked. The nickel ores are not previously prepared, as the matrix gives a suitable slag.

The average composition of these ores is:—

Dolomite	CaO,CO_2 8·07; MgO,CO_2 8·13
Sparry iron ore	FeO,CO_2 22·86
Copper pyrites	$Cu_2S+Fe_2S_3$ 21·98
Nickeliferous pyrites	$\left.\begin{matrix}\frac{8}{9}Ni\\\frac{1}{9}Fe\end{matrix}\right\}S$ 6·88
Bismuth glance	BiS_2 2·05
Iron pyrites	FeS_2 7·72
Red hæmatite	Fe_2O_3 11·61
Quartz	SiO_2 10·33
Moisture	0·27
As,Co,KO,NaO	0·30
	100·20

Other analyses make the nickel to exist as capillary pyrites (NiS)—this mineral is seen now and then in the ores. The ore yields on an average 3 per cent of nickel and 5 per cent of copper. In 1857, Heusler introduced a process for the production of a nickel-copper alloy similar to the Swedish one.

The process may be divided into four parts.

1. Raw Melting.—Roasting the ore and smelting it to coarse metal.

2. Concentration Melting. — Roasting the coarse metal and smelting it to a concentrated regulus.

3. Refining Melting.—Separation of the iron from the concentrated regulus.

4. Roasting and Reducing Process.—Transformation of the regulus into oxides of copper and nickel by roasting, and reduction of the oxides to copper-nickel.

1. Raw Melting.—The ore is crushed to pieces of the size of a man's fist and roasted in kilns. On the sole of the furnace are bedded about $\frac{1}{10}$ cwt. of charcoal, then $\frac{1}{4}$ cwt. of brown coal, then 15 cwt. of ore, then again $\frac{1}{4}$ cwt. of brown coal, and finally 25 cwt. of ore. The charcoal at the bottom is lighted, and, after 12 hours, the roasting will have proceeded so far that three-fourths of

the ore may be taken out of the furnace as being well roasted. Brown coal and ore are again put on in layers. 100 cwt. of roasted ore is mixed with 63 cwt. of slag from the former melting, and smelted with coke in a furnace. This is filled with charcoal, which is lit and allowed to burn down a little, which having taken place, one barrow of coke and two of slag are put on, and the blast-engine worked. Two barrows of mixture are now put on to one of coke, and, by a gradually increasing amount, seven or eight barrows of mixture are added within a few days to one of coke. (One barrow of coke = 20lbs.; of mixture = 30lbs.) The silicious slags from the copper-ore smelting are the most convenient to employ. One operation usually lasts six weeks.

2. Concentration Melting.—The regulus is now stamped and passed through sieves. It is then roasted in a reverberatory furnace. The charge of the furnace is 10 cwt., the volume of which becomes doubled by roasting.

The firing in the beginning of the process is kept low, as the heat increases by the oxidation of the charge. After two hours the heat is raised, till at the end of the process it reaches a white heat. During the last two hours powdered charcoal is added to decompose any sulphates formed.

Sohnabel has made most careful analyses of the regulus removed at different times during the process. From these it is found that the desulphurisation takes place gradually.

The regulus still contains 7 per cent sulphur. It is again smelted, being now mixed with 1 per cent of lime. 100 cwt. is prepared with 67 cwt. of silicious copper cinders, poor in oxide. The charge commences with 2 barrows of preparation to 1 barrow of coke, and the proportion increases to 5 or 6 barrows in 24 hours.

3. Refining Melting.—This melting operates as an oxidation process, and is used to separate completely the iron. It is carried on in a copper refining furnace with silica. Here the concentrated regulus is smelted with coke, when it melts and falls in drops to the bottom of the furnace. The iron remains in the slag as silicate of protoxide of iron, which is easily fusible.

To melt 170 lbs. of regulus it takes about 1¾ hours. The fuel is now taken out of the furnace, and the slag on the surface of the metal, cooled by a blast and renewed. The process is renewed with fresh flux, and repeated until the slag possesses an enamel-like appearance, a proof of the separation of the iron. The resulting metal is melted and drawn off by a gutter in the smelting hearth.

4. Roasting and Reducing Process.—The nickel-copper regulus thus obtained is now converted by roasting into oxides of nickel and copper. For this purpose it is ground to powder and sifted through very fine sieves; 4 cwt. of the powder are spread out on the hearth of a reverberatory furnace, and are roasted for 12 hours, being continually and thoroughly stirred up. The regulus by this roasting becomes desulphurised till it contains not more than ¾ per cent. The powder is then again roasted for 8 hours, at first at a red heat, and finally at a white heat. By this treatment all the sulphur, and also the small amounts of antimony and arsenic still retained, are separated.

The manipulation used in this latter process is kept a secret. The writer presumes that the regulus is mixed with carbonate and nitrate of potash; by heating with this mixture sulphantimoniate and arseniate of potash would be formed,—compounds soluble in water. The oxides of copper and nickel have now only to be reduced to the metallic state. The moistened oxide, in charges of 150 or 200 lbs., is reduced in a charcoal furnace.

The slags contain nickel and copper, partly scorified, partly mechanically suspended. They are reserved for re-smelting.

The result of the process just described is an alloy of copper and nickel; the nickel is therefore in a convenient form for use in the manufacture of German silver.

ON THE INACTIVE CONDITION OF SOLID MATTER.

In the Chemical News for Nov. 30, 1866, we gave an account of some remarkable experiments by M. Gernez, as recorded in the *Comptes Rendus* for 19th November, 1866. It is well known that when a solid body, such as a glass rod, is introduced into soda water, seltzer water, or other supersaturated solutions of a gas, it becomes immediately covered with gas bubbles, and even effervescence may set in. The rod, however, becomes inactive after a short time, or it may be made so by previously immersing it in water, or by heating it in the flame of a spirit lamp, or by keeping it out of contact with air. The theory is that it is not the solid that disengages the gas from its solution, but the air in contact with such solid. The inactive solids become active if exposed to the air for a quarter-of-an-hour or an hour. Every solid, however smooth, is covered with roughnesses that form a sort of network of capillary conduits, into which surrounding gases penetrate and condense; and the gas bubbles thus imprisoned act as centres of force in liberating gas from solution. The rougher the body the more brisk the effervescence. The disengagement of gas ceases in time, since each bubble carries with it a portion of the gas which produced its liberation. Heat expels the gas from the surface of the solid by expansion, and immersion in water by solution.

In order to support this view, the author relies upon the following experiment:—"I introduced into a supersaturated aqueous solution of carbonic acid an almost capillary tube, closed at one end and inverted like a gas-jar, and containing air. I had previously deprived this tube of the property of liberating gas. Immediately after immersion, gas adhered to the column of air which the tube contained, forming quickly a large bubble, which was disengaged; then another was produced, and so on. The gas formed then only at the point where the liquid touched the column of air. From this experiment, which I have varied in several ways, it may be concluded that air liberates carbonic acid from its aqueous solution." It is further stated that the nature of the gas is of no consequence, for "supersaturated solutions lose their gas under the influence of any gas bubbles whatever."

In the August number of the *Philosophical Magazine* Mr. Tomlinson, F.R.S., of King's College, combats the above theory, and denies that air or gas has any action in liberating gases from their solutions. The theory that he proposes to substitute rests on the distinction between a chemically clean solid and one that is clean in the ordinary sense of the word. If the solid be chemically clean there is perfect adhesion between it and the solution, and there is no liberation of gas; if the solid be not chemically clean, then the adhesion is imperfect, and there is a separation of gas. If the water is not attracted by the solid, the gas is; for although the rod may not be clean enough for water to adhere to it, yet gas will adhere to a dirty or a greasy rod. If the rod be made chemically clean it soon ceases to be so by exposure to the air; and this circumstance, according to Mr. Tomlinson, has led the numerous writers on supersaturated solutions of salts into error as to the action of *nuclei*, &c., in inducing crystallisation. If the nucleus be chemically clean, the solution wets it perfectly, and there is no separation of salt from the water; if the nucleus be not chemically clean the adhesion is differently distributed between the water and the salt, or the water and the gas, and there is a separation. According to this view a chemically clean body which appears to be "inactive," is really most active; while the so called "active" condition is really one of imperfect adhesion.

We select a few of Mr. Tomlinson's experiments in support of this novel view, which, if admitted, will throw a great deal of light on a very obscure object:—

Experiment 1. Two ordinarily clean test-glasses, A and B, were taken; A was first filled with methylated spirits

of wine and then rinsed with abundance of water. A bottle of soda water was now poured gently into the two glasses. The inner surface of B was profusely covered with gas bubbles, but not a single bubble was seen on the surface of A.

Experiment 2. A glass rod and a platinum spatula were dipped into A and B, and produced abundant effervescence. They were dipped into spirits of wine, rinsed, and again put into A and B. Not a bubble of gas appeared on either surface, except above the points at which the bodies had been made chemically clean, and there numerous gas bubbles appeared. Indeed it was accurately determined by the formation of these bubbles how far the solids had been dipped into the spirit.

Experiment 3. A rat's-tail file made chemically clean did not liberate any gas; but dried and drawn through the moist hand (experiment 4) it liberated gas abundantly.

In like manner dry iron filings (experiment 5) that produced effervescence, did not do so after being washed in spirit; when thrown wet into soda water the spirit was of course displaced by the liquid, and the filings were wetted by it, and yet there was no liberation of gas.

A wire gauze cage (experiment 7) full of air was lowered into soda water and there was no escape of gas so long as the cage was chemically clean; when the cage was handled with dirty hands (experiment 8) and put into the soda water there was an abundant effervescence.

Experiment 9, A glass rod was heated in oil above 300° F; then wiped with a duster and put into soda water. It was instantly and completely covered with gas bubbles.

Experiment 11. A large fragment of flint was broken into two pieces and put into soda water. Gas was abundantly liberated except from the two new and chemically clean surfaces, and on them not a bubble was seen.

Experiment 12. A narrow tube eleven inches long was kept in spirits of wine for an hour for five inches of its length. It was closed at top and so lowered into soda water. There was no liberation of gas either from the tube or the column of air in contact with the solution. On removing the finger, the solution ascended the tube, but there was no liberation of gas until the solution touched that part of the tube which had not been immersed in the spirit, and from this gas was liberated both from the outside and inside of the tube. It is remarked that had M. Gernez made the inside of his tube as "inactive" as he made the outside, he would have seen that the column of air had really no action in liberating the gas.

ON THE

UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

(Continued from page 46).

Looking, therefore, at the compositions of the principal products of coal tar distillation, it may be said that the *crude naphtha* contains certain alliaceous oils, with benzole, toluole, xylole, cumole, and a little cymole, besides the more volatile basic compounds, as pyridine, picoline, lutidine, collidine, and a little aniline, with from 2 to 3 per cent. of carbolic acid and a little naphthaline.

Light oil contains cumole, cymole, and the other less volatile hydrocarbons, with a large amount of naphthaline, and the denser alkaloids, as collidine, aniline, toluidine, and even a little chinoline; besides which it contains from 10 to 20 per cent. of carbolic and cresylic acids.

Heavy oil consists chiefly of hydrocarbons which have not been well studied, and the bases which have a high boiling point, as chinoline, lepidine, and cryptidine, with small quantities of cumidine and cymidine, and from 7 to 10 per cent of carbolic and cresylic acids.

Carbolic acid ($C_{12}H_6O_2$), or as it is sometimes called *phenic acid*, is largely in demand for making dyes and for disinfecting purposes, and it is most profitably extracted from the light oil before it is distilled for benzole, &c. The naphtha which flows over between 300° and 400° Fahr., and which has a gravity below 900, is best suited for the preparation of carbolic acid; for although there is much acid in the heavier oils, yet they are so nearly of the same gravity as the alkaline solution used in extracting it that there is great difficulty in separating them. The light oil is well shaken with about one-third of its bulk of a solution of caustic soda of from 14° to 16° Twaddle (1·07 to 1·08 sp. gr.) and containing from 5 to 7 per cent of alkali. After standing for some time the oil separates, and the alkaline liquor may be drawn off by means of a syphon. This is to be neutralized with sulphuric or muriatic acid, and then the carbolic acid floats as a dark brown oil. This is the crude acid of commerce, and when purified by means of sulphuric acid and careful distillation from chloride of calcium, it forms the camphor-like substance which you here see. It has a peculiar creosote-like smell, and when largely diluted with water, even to the extent of 1 part in 10,000, it has a sweet taste. It is a very powerful caustic, turning the skin white and quickly raising a painless blister. The specific gravity of the pure acid is 1·065. It melts at from 95° to 98° Fahr., but the merest trace of water will lower its melting or congealing point, so that this is the test of the quality of the acid. It boils at 369° or 370° Fahr., and its vapour burns with a sooty flame. If it be passed through a red-hot tube it is decomposed, forming naphthaline and other hydrocarbons; and if it be heated for some time with ammonia in a closed tube, at a temperature of from 400° to 500° Fahr., it produces aniline and water thus :—

$$\underbrace{C_{12}H_6O_2}_{\text{Carbolic acid.}} + NH_3 = \underbrace{C_{12}H_7N}_{\text{Aniline.}} + 2HO$$

It combines with alkalies to form salts, but the combination is very feeble, for the acid is set free by heat and even by the carbonic acid of the atmosphere, so that the common preparation of it, carbolate of lime, slowly evolves carbolic acid when it is exposed to the air.

The acid is a very powerful antiseptic and disinfectant. It is especially destructive of the lower forms of organic life, and hence, perhaps, its value as a disinfectant. Several varieties of the acid are now prepared and sold for general and medical purposes, and the experience of the last few years has proved it to be an important hygienic agent. Its use in the preparation of dyes will be explained directly.

The other acids of coal tar, as *cresylic* ($C_{14}H_8O_2$), *phlorylic* ($C_{16}H_{10}O_2$), *rosolic* ($C_{24}H_{12}O_6$), may be obtained by the use of a stronger alkaline solution as recommended by Laurent. A saturated solution of potash, added to the mixed light oil and heavy naphtha, and then treated with a little powdered caustic potash, will produce a magma from which the unattacked liquid oil may be separated. By dissolving it in a small quantity of water and allowing it to stand, it separates into two layers—an upper oily layer which is of no use, and a lower layer which contains the tar acids. When this is neutralized with muriatic acid, the crude acids float as an oily layer, and may be separated from each other by fractional distillation.

IV.—Spent Oxide of Iron.

This is the next substance in order of the purification of coal gas. In its fresh state the hydrated peroxide of iron freely absorbs the sulphuretted hydrogen of foul gas, forming the black sulphide of iron. On exposure to the air the iron again absorbs oxygen, and becomes revived—the sulphur which it had before taken in as sulphuretted hydrogen being set free among the particles of the oxide. In this manner, by a succession of foulings and revivifications, the oxide becomes so charged with sulphur as to be unfit for use. It then contains from 35 to 57 per cent of sulphur, the average being about 42 per cent; and

although it is useless at the gas-works, it is of some value in the production of oil of vitriol. Special furnaces, however, are necessary for its combustion, for as it contains about 20 per cent of sawdust it is not capable of being used in ordinary sulphur furnaces. At Messrs. Lawes and Messrs Hills, where I have seen the spent oxide largely used for making sulphuric acid, the furnaces are constructed with very long flues, for the purpose of completely burning the organic vapour before it enters the vitriol chamber. Each furnace is about 12 feet long and 18 inches square, with a floor of fire-brick, upon which the oxide burns. It takes about 2½ cwts. of oxide at a charge, and it burns continuously for twelve hours. The air is admitted by a sliding door in front, and the gaseous products are conveyed from the furnaces, which are placed side by side, and in three tiers over each other, to a common flue at the back, and this is extended backwards and forwards, below and above, so as to prolong the combustion to the greatest extent before the vapours enter the vitriol chamber, for if the combustion is not complete there is a considerable waste of nitre; as it is, indeed, the quantity of nitre used for the oxidation of the sulphurous acid is always about half as much more as is required with native sulphur or pyrites. I think the process might be very considerably improved by continuous instead of intermittent burning, and there is no reason why the use of sawdust may not be abandoned altogether, and spent oxide employed in its place.

V.—Spent or Refuse Lime.

This is generally a very profitless material—in fact, the blue billy from the wet-lime purifiers is incapable of any sort of application but that of luting. Dry lime, however, is not so unmanageble a product, for if it is treated properly it need not occasion offence; and when it is well weathered it is of some value to the farmer. Professor Voelcker has inquired very fully into this matter, and he states that it is useful to certain soil on the following account:—

1. It improves the texture of stiff clay soils by lightening them, and of light sandy soils by giving them solidity.
2. It neutralizes the acidity of some soils, and breaks up the organic matter of soils which are too rich in humus, making them more fit for the sustenance of plants.
3. It acts on the granitic constituents of a soil, and sets free the alkalies, thereby making the mineral elements of it available as food for the plant.
4. It supplies food to the plant in the form of sulphate of lime, which is especially useful to the leguminosæ.

And he concludes that well weathered gas lime, judiciously applied to a proper soil, is most useful to many plants, as clover, sainfoin, lucerne, peas, beans, vetches, and turnips; and that it is a good fertilizer, for permanent pasture, especially if the land is deficient of lime. On natural grasses the best farmyard manure often produces but little improvement until a dressing of lime, marl, or gas lime has been applied to it: the latter, more particularly, destroys the coarser grasses, and favours the growth of a sweeter and more nutritious herbage. It also destroys moss, heath, feather-grass, and other plants which are characteristic of peaty land. It is therefore, especially suited for the improvement of such land; and so it is for the land which is deficient of lime, and which causes turnips to become warty, and be affected with the disease called "fingers and toes." For this it has been found a complete remedy. It may be applied in quantities of from one to two tons an acre, and even more where lands are very heavy, or are very peaty; and the best time to apply it is in the autumn, when vegetation is dormant, so that it can not only weather before the spring returns, but also act on the land during the whole of the winter.

One special precaution is that the lime should never be used in its fresh state, when it contains sulphide and sulphite of calcium in such proportions as to be injurious to plants. The more it is oxidized the better, and, therefore, when it is drawn from the purifiers it should be covered over with old material, so as to prevent smell, and kept until it has lost its activity. The fresh lime contains from 15 to 25 per cent of quicklime, with a large proportion of sulphide, carbonate, and sulphocyanide of calcium; and even after six or eight months it may still contain a notable proportion of quicklime, with from 20 to 30 per cent of sulphate of lime, a like proportion of sulphite of calcium, and still more of carbonate, in which condition it is not injurious to plants.

In many places farmers are glad to have the material, and will give as much as 2s. a load for it, although the common price is about 1s. a load.

VI.—Acid and other Absorbents of Ammonia.

At the end of all the purifiers there may be placed the material which has been patented by Messrs. Sugden and Maryatt. It is made by moistening sawdust with sulphuric acid slightly diluted with water, and heating it in a retort. The woody matter is in this way charred by the acid, and contains from from 30 to 45 per cent of free sulphuric acid. When it is exhausted by being charged with ammonia, it contains 40 to 60 per cent of salt, which is easily washed out of it, leaving the charred sawdust ready for another charge of acid, The material, with the sulphate of ammonia in it, is fit for conversion into manure, and is worth £5 or £6 per ton. Another absorbent of a like nature is that used by Mr. Croll. It is made from the spent chloride of manganese from the bleaching-works by adding it to chalk and sawdust, and, when saturated with ammonia, it contains from 39 to 40 per cent of muriate of ammonia, which is easily obtained from it either by washing or subliming.

These are several waste products of the manufacture of gas, and it will be seen that, in the aggregate, their value is not inconsiderable provided they are utilized to the fullest extent.

(To be continued.)

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Your correspondent is so profoundly impressed with the vulgarity of enthusiasm, that he has endeavoured to the very utmost to suppress any traces of that objectionable sentiment in his letters. In fact, it is very difficult to be guilty of the fault alluded to after spending a week in the Exposition. Gazing at works of science or art for a long time, especially if one is to write about them, produces a state of mind in which an almost stupid tranquillity is a prominent feature, and your correspondent verily believes that the "dignified repose" which the world admires in some of its idols, is often so nearly allied to stupid tranquillity, and is so difficult to distinguish from it, that it may be said to be merely an isomeric modification. The poor worn-out Frenchman who complained so bitterly that he had had "beaucoup de Sultan," told me in confidence that the air of dignified repose which so eminently distinguishes Abdul Aziz when inspecting the greatest triumphs of science, was in fact the stupid tranquillity of ignorance. He also informed me that the predecessor of Abdul-Aziz (Abdul-as-was ?) generally enjoyed the same enviable state of mind. Certain it is, that the only thing in the building which caused a smile of intelligence to pass over the Sultan's face, was a punching machine in full work, and when he was told by his interpreter that it was capable of administering 1,000 punches a minute, he replied with decided animation, that he would take one home for the benefit of the heads of those who had persuaded him to

leave Turkey. Let us hope that the fatigues to which you will subject that unhappy potentate in England, will make him forget his severe (although just) determination. To return to our work :—

Your correspondent examined with great interest the two cases of Messrs.Calvert and Lowe. They are described in the English catalogue as follows :—

14. Calvert, F. Crace and Co., Gibbons Street, Bradford, near Manchester. Carbolic acid, &c. 60. Lowe, Charles and Co., 14, Fountain Street, Manchester. Carbolic acid and its derivatives, &c.

The chemist who would follow the history of carbolic acid would have to pass in review one of the most interesting phases in the whole of organic chemistry. Discovered in 1834 by Runge, it forms one of the vast number of intensely interesting substances presented by that remarkable man to science as mines of wealth to be explored step by step, and more and more minutely, as methods of investigation were perfected. It is, in fact, one of those products of destructive distillation, whose history, which reads like a romance, has been developed by the labours of nearly all the greatest names associated with organic chemistry—Runge, Laurent, Gerhardt, Wöhler, Kopp, Hofmann, Williamson, Kolbe, Cahours, Erdmann, Fritzsche, Piria, Liebig, Dumas — all these names are found at the head of the memoirs in which are developed step by step the history of carbolic acid.

Carbolic acid, known also as phenol, phenic acid, hydrate of phenyl, phenylic alcohol, and coal tar creosote, has the formula C_6H_6O, and may be represented as water in which one atom of hydrogen is replaced by the radical phenyl. It is produced in a state of considerable purity by distilling salicylic acid ; the carbolic acid from this source has, however, been asserted, too hastily, to be only isomeric with the coal-tar substance.

The fact is, that until very lately, chemists had no opportunity of working with carbolic acid of perfect purity. This has led to many incorrect ideas regarding it ; for example, one of the differences between the carbolic acid from coal tar and that from salicylic acid, has been said to be the greater rapidity with which the crystals from the former source liquefy when exposed to the air, but, when perfectly pure, crystals of the coal-tar acid may be exposed without deliquescing for months together.

It is remarkable, moreover, to find that the substance whose properties we are discussing, is one of those which, as far as purification goes, has been grappled with more successfully in the manufactory than in the laboratory. The most severe test for the purity of carbolic acid, like that of most crystalline organic substances, is its melting point. According to Gerhardt this is between 34° and 35° (*Chimie Organique*, iii. 16.) But crystalline carbolic acid can now be obtained in commerce, of which the melting point is as high as 42°, or even a little higher. On the other hand, the boiling point of this pure acid is given by Mr. Lowe as 182° thermometer, in liquid, or 178°·8 thermometer in the vapour, the atmospheric pressure being 743·19 mm. (29·26 inches), whereas Laurent gives 187°—188°, and Scrugham, who worked on the subject in the laboratory, and under the eye of Williamson, gives 184°. From this we conclude that pure carbolic acid has a much higher melting point, and a somewhat lower boiling point than has been ascribed to it hitherto.

Messrs. C. Lowe and Co. exhibit a large mass of absolutely pure carbolic acid, weighing no less than two cwt., having the melting and boiling points given above. It is proper to mention that Dr. Crace Calvert, who is fully cognisant of all the facts recently discovered relating to carbolic acid and its congeners, gives 187° as the boiling point of carbolic acid* agreeing nearly with the determination of Laurent.

The firm of F. C. Calvert and Co. were the first to manufacture carbolic acid in a comparatively pure condition ; it then consisted in a colourless fluid yielding crystals at 15°. This was in 1859, In 1861 they succeeded in obtaining it in colourless detached crystals, fusing at about 25°. Two years later the manufacture was so far improved that the melting point of their best acid was raised to 34°, the number given by Gerhardt. At the end of 1864 they succeeded in removing the sulphur compounds which adhere with such tenacity to the acid products of coal tar, and thus rendered the carbolic acid fit for medicinal purposes. It was not until 1866, however, that the absolutely pure acid was isolated with a melting point between 41° and 42°. Other manufacturers do not appear to be aware of the processes employed by Messrs. Calvert and Lowe, for they do not exhibit in their cases acid of a higher melting point than about 25°.

Messrs. Lowe and Co. state that absolutely pure carbolic acid *does* slowly become coloured by exposure to light, and that when this coloration is not observed, it arises from the protective influence of certain impurities, apparently sulphur compounds.

Messrs. Calvert and Co. also exhibit their disinfecting powder, salve for foot rot in sheep, and sheep dip, also picric acid and aurine, and, finally, rosolic acid.

Messrs. Lowe also exhibit picric acid, prepared by the action of nitric acid on sulpho-phenic acid, a process which is said to have several advantages, particularly as regards the quantity of the resulting product. They also show rosolic acid and a fine lake prepared from it for the use of paper-stainers. In addition to the above they have in their case picramic acid prepared by reducing picric acid with an alkaline sulphide. It is used in commerce for dyeing browns.

Messrs. Lowe's case contains a series of specimens which almost exactly represent the various epochs of the improvements in the manufacture of carbolic acid, alluded to above. They consist of the various commercial qualities, having the following melting points :—

Crude carbolic acid, fluid at ordinary temperatures.					
Purified	do.	,,	melting	at	15°
,,	,,	,,	,,	,,	29
,,	,,	,,	,,	,,	35
Pure	,,	,,	,,	,,	42·25

They also exhibit what they and Dr. Calvert insist on calling bi-hydrate of phenyl. This substance is simply carbolic acid, with water of crystalisation. Dr. Calvert's formula (C = 6) is

$$C_{12}H_5O.2HO.$$

But as the water of crystalisation is given off on the application of heat, it is obvious that the true formula is :—

$$(C = 6)\quad 2C_{12}H_6O_2.2HO, \text{or :—}$$
$$(C = 12)\quad 2C_6H_6O.H_2O.$$

It gives your correspondent much pleasure to admit the gratification he derived from the examination of the cases of Messrs. Calvert and Co., and Messrs. C. Lowe and Co. Messrs. Calvert and Co's., case would, however, have appeared to much greater advantage if the globes containing the specimens had not been covered to such an extent by loose paper advertisements, which to a great extent hide the contents.

Messrs. Calvert and Co. have obtained a silver, and Messrs Lowe and Co. a bronze medal.

Fusibility of Aluminates containing a large amount of Lime.—(Fremy.) Mixtures of 80 parts lime and 20 alumina and 90 parts lime and 10 alumina become completely liquified when heated in crucibles in a wind furnace. Mixtures of 93 lime and 3 alumina still frit at such temperature. The cooled masses have crystalline fracture, alkaline reaction, swell up in water, and may be used in metallurgy on account of their affinity for sulphuric and phosphoric acid.—(*Dingl. F. bd.* 177, p. 376.)

* *Chem. Soc. J.*, xviii. 66.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, July 30, 1867.

Discovery of the Cromlech of El-lanic.—Ancient pottery, worked flints, and stone hatchets.

At the last meeting of the Polymatic Society of Morbihan, M. de Closmadeuc gave a description of a very fine cromlech discovered by him in a very small desert island in the gulf of Morbihan, called El-lanic, situated south of Gavara's. This cromlech is represented by more than sixty obelisks of granite forming a vast regular circle of 180 mètres in circumference. The mean length of the blocks is three mètres. One of the blocks is of colossal size; it is broken into two fragments, and measures 5·30 mètres long by two mètres thick. A curious fact worthy of notice is that one half of the cromlech is no longer on the island but on the sea shore, so that the view of the whole circle is only attainable at low water; the sea has encroached by degrees on the island on the south side where the cromlech is found, and eaten away half the ground.

M. de Closmadeuc, who has made excavations in the neighbourhood, has discovered an incredible mass of ruins and antiquities, the nature of which cannot be doubted:—1. An enormous quantity of pottery perfectly similar to those habitually found in Celtic monuments. 2. A quantity not less considerable (several hundreds) of flints worked by man, analogous to those found in ossiferous caverns, or of Grand-Pressigny. 3. A great number of stone hatchets which have been found under the Armorican Dolmens.

The discovery of the cromlech of El-lanic is of great interest. It is most remarkable and the most complete of the cromlechs hitherto known in the Morbihan.

ACADEMY OF SCIENCES.

July 22, 1867.

(From our own Correspondent.)

Sir D. Brewster on liquid films and figures of equilibrium.—Storms exceptionally caused.—Proportion of iodine in mineral waters.—Classification of meteorites.—Discovery of universal gravitation, letters of Pascal to Boyle; Discussion; Newton and Pascal in correspondence.

Sir David Brewster addressed copies of his pamphlets (reprinted from the Royal Society of Edinburgh) on the colours of thin liquid films and their figures of equilibrium, of which we have already published the analysis. The illustrious professor, foreign associate of our academy of sciences, at the age of 85 years, retains his memory so fresh and bright that the two memoirs in question seem to be the offspring of a youthful mind.

M. Fournet of Lyons addressed a note on the exceptional storms caused by the south-west winds.

We understood, vaguely, that there were communications on geological sections of the Alencon railway—of a memoir by M. Thibaut on inundations—of an efficacious method of treating croup, by Dr. Abièlle—of researches on electricity by M. Girard—of a means of ascertaining the proportion of iodine contained in mineral waters and in alkaline salts—of a memoir by M. Humbert on the resistance of a voltaic pile, &c.

M. Daubree read the second part of his memoirs on the classification adopted for the collection of meteorites in the Museum of Natural History. His principal divisions of solid and coherent meteorites are as follows:—1st Class: *Siderites*—meteors containing iron in a metallic state; sub-division, containing stony substances. 1. *Holosiderites*—Meteoric iron properly so called; second subdivision containing iron and stony substances. 2nd Group: *Syssiderites*—iron in the form of a continuous mass. 3rd Group: *Sporadosiderites*—iron in the form of disseminated grains; 1. Sub-group of sporadosiderites. *Polysiderites*, when the quantity is considerable. 2. Sub-group: *Oligosiderites*, containing a small quantity of iron. 3. Sub-group: *Cryptosiderites* in which the iron is invisible to the eye. 3rd Class: *Asiderites*. 4th Class: *Asiderates*.

M. Le Verrier called upon M. Chasles relative to the letters and notes of Pascal printed in the Comptes rendus, and of which we give, before resuming this long discussion, a few important passages:—8th May, 1652, Pascal to Boyle—"J'ay pour le prouver un bon nombre d'observations de toutes sortes dont personne m'a encore parlé, et partant en connaissance, tant sur l'attraction et de ses lois avec les phenomènes. Je viens vous en faire part. Vous trouverez ci-joint les experiences, au nombre de plus de cinquante. . . . . "Pascal."

2 Sept., 1654 or 1655.—Again to Boyle.—"Dans les mouvements celestes, la force agissant en raison directe des masses et en raison inverse du quarré de la distance suffit à tout, et fournit des raisons pour expliquer toutes les grandes revolutions qui animent l'univers. Rien n'est si bon selon moy; mais quand il s'agit des phenomènes su blunaires, de ces effets que nous voyons de plus près et dont l'examen nous est plus facile, la vertu attractive est un Protée qui change souvent de forme. Les rochers et les montagnes ne donnent aucun signe sensible d'attraction. C'est, dit-on, que ces petites attractions particulières sont comme absorbées par celles du globe terrestre, qui est infinement plus grands. "Pascal."

Note to Boyle.—"Le corps en vertu de la tendance au mouvement que l'attraction lui imprime est capable de parcourir un espace donné dans un temps donné. La vitesse initielle sera donc proportionelle a l'intensité de l'effort ou de la tendance imprimée par la puissance attractive; et cette intensité sera elle-même proportionelle à la masse attirante a egale distance, et (à) differentes distances, comme la masse attirante divisée par les quarrés de ces distances.

"Les observations astronomiques apprennent que toutes les planètes se mouvent dans une courbe autour du Soleil, et qu 'elles sont accelérées dans leur movement à mesure qu 'elles approchent de ce globe, et qu 'elles sont retardées à proportion qu 'elles s'en eloignent, tellement qu 'un rayon tiré de ces planètes au Soleil décrit des aires ou des espaces égaux en temps égaux. "Pascal."

"J'ai dit que la force de projection qu'on nomme force centrifuge varie continuellement, parce que l'attraction est plus ou moins grande suivant que les planètes s'approchent ou s'eloignent du soleil. Pour concevoir comment cette révolution s' opère, supposons qu'une planète soit à la partie de son orbite (ou de l'ellipse qu'elle parcourt) la plus proche du soleil, la force attractive est dans cet état plus grande que dans toute autre situation, à proportion que le quarré de la distance est moindre. Elle devroit donc faire tomber la planète sur le soleil, mais la force centrifuge produite par le mouvement circulaire autour du soleil augmente en plus grande proportion. "Pascal."

"La puissance qui agit sur une planète plus proche du soleil est ordinairement plus grande que celle qui agit sur une planète plus éloignée, tant parce qu'elle se meut avec plus de vitesse qu'à cause que son orbite est moindre et qu'elle à plus de courbure. En comparant les mouvements des planètes, on trouve que la vitesse d'une planète plus proche est plus grande que la vitesse d'une planète plus éloignée, en raison de la racine quarrée du nombre qui exprime la plus grande distance à la racine quarrée de celuy qui exprime la moindre distance. "Pascal."

"On peut conjecturer et même inférer qu'il y a une puissance semblable à la gravité des corps pesants sur la terre, qui s'étend du soleil à toutes les distances et diminue constamment . . . Le même principe de la gravité doit avoir lieu dans les satellites qui circulent autour de la terre, de Jupiter et de Saturne. . . . Car ils ne pourroient avoir un mouvement aussi régulier qu'ils ont s'ils n'estoient assujettis a l'action de la mesme puissance, &c. "Pascal,"

The intimate acquaintance of Newton with Pascal is proved by letters written by Newton in most excellent French. Newton was then only eleven years old.

The question that M. Leverrier at last put forth, after endless circumlocution, was this:—Is M. Chasles in possession of letters and notes which demonstrate undoubtedly that Pascal knew, not only the laws, but the demonstration of universal gravitation? M. Chasles hesitated to answer, because he would wait till the termination of the discussion of that which he had already spoken of to the academy; he consented, however, to acknowledge that it results from the authentic autographs in his possession that Pascal had determined centrifugal force in the curvilinear motion of the planet; thus, this determination implies the demonstration of the elliptical nature of the curve described under the influence of attraction.

MM. Duhamel, Elie de Beaumont, Pouillet, Faye, Le verrier and Chasles took part successively in the discussion, but on subjects not bearing directly on the question. M. Duhamel supported the adversaries of Newton; he could never understand how he gave, at so late a period, the mathematical expression of the law of gravitation in inverse proportion of the square of the distance. By replacing the ellipse by its osculating circle, he had early found the geometrical expression of the attraction, but it was necessary to deduce from synthetic considerations the value of the radius of curvature of an ellipse, which he could not do later. This geometric determination is very remarkable, and we shall shortly give further accounts of it.

It was well seen with what care M. Chasles avoided avoided pronouncing the name of Newton in his paper. It is not generally known that when Newton was only fourteen years old, Pascal was in correspondence with Newton, and it was at his advice that Mrs. Newton sent her son to Cambridge. This unexpected announcement is most important, especially when these extraordinary documents prove that Pascal was aware of the laws of universal gravitation. Certainly M. Chasles ought to be left at full leisure to prepare his dissertation, which is waited for impatiently by the scientific world.

M. Chevreuil laid on the table two pamphlets relative to Natural History and the Gobelins; the first is a most complete work describing the physical, chemical, and organic properties and relations of all bodies.

NOTICES OF BOOKS.

Observations upon a New and Simple Process for the Preservation of Meat, Fish, Poultry, and other Varieties of Animal Food. London: Simpkin, Marshall, & Co.

A new process for the preservation of meat by means of a solution of bisulphite of calcium, has been lately patented by Messrs. Medlock and Bailey; and the pamphlet we are about to discuss has been written with the object of describing the process and its application. It is somewhat unfortunate that the writer adopts the style usually displayed in the commencement of such descriptive pamphlets. He proves satisfactorily to himself that all the processes hitherto employed for the purpose to which this patent is applied are lamentably defective. It is needless to mention the objections raised in each particular case, and it is much to be regretted that the author does not confine himself to a statement of the undoubted advantages possessed by the special process which he advocates, without drawing invidious comparisons.

The preservative employed by Messrs. Medlock and Bailey is undoubtedly a very powerful one, and although its application to the purpose of preserving food may be new, the antiseptic properties of sulphite of calcium have long been recognized; it is, indeed, one of the chief components of McDougall's powder. In the patent now brought before us however, the more soluble bisulphite is employed. This compound possesses several advantages over other sulphites, which will strike chemists at once. It is easily obtained free from sulphate, and if any sulphate should be afterwards formed by oxidation no unpleasant taste would be noticed by the consumer; these points have probably operated against the extended use of sulphite of sodium. The low equivalent of calcium is also somewhat in its favour. Messrs. W. Bailey and Sons have engaged to manufacture the bisulphite of calcium, and guarantee to deliver it absolutely pure. With regard to the results that have been obtained, as set forth in the pamphlet, they are remarkably good. The ordinary preservative solution is made as follows:—Dissolve about a pint of common salt in four gallons of clear cold water, to which add half-a-gallon of the bisulphite, and mix well: if the meat, &c., to be treated is required to be preserved for a very long period, a little solution of gelatin or white of egg may be added with advantage. All kinds of meat may be kept perfectly sweet by simply soaking the joints in the above preservative solution for ten minutes, and then hanging them up, wetting them again with the solution once a day.

It is stated that beef, mutton, lobsters, &c., treated by this process, kept good for twelve days with the temperature varying between 80° and 110° F., the original odour and flavour remaining unimpaired at the end of the time. In twenty-six hours portions of the same animal matter, unprepared, were absolutely putrid.

The process seems likely to prove valuable both to the public and the patentees.

CORRESPONDENCE.

MAGNETISM AND GRAVITATION.

To the Editor of the Chemical News.

Sir,—In reply to A. D., I cannot admit that "both the induced poles of a body undergoing magnetic induction may be regarded as at the same distance from the inducing pole thereby rendering the attraction nil." The side nearest the inducing pole being attracted, and the side furthest repelled, the attraction will always predominate over the repulsion. This is true for an inch, or a foot, and why not for any distance.

When a small needle, previously magnetised, is gently laid on the surface of water so as to float thereon, it arranges itself in the magnetic meridian, although the distance of one end of it from a magnetic pole may be only a fraction of an inch more than that of the other in a total distance of several thousand miles. Again, we know that if a magnet be placed at some distance either above or below the pan of a balance, it diminishes or increases the weight of any magnetic substance placed in the pan. Also, if a magnetised needle be introduced into the pan of a balance, below which a magnet is placed, the apparent weight of the needle varies according as we arrange it with its poles similar or opposite to those of the magnet placed beneath it. The apparent weight of a magnetic substance may then be altered at pleasure, or even reduced to nothing. Thus, when a small needle is attached to the ground by thread fixed to one, or preferably, to both ends, and a horse-shoe magnet is held above it, the needle may be suspended in the air at a distance of an inch or more from the magnet, its apparent weight being thus practically reduced to nothing.

Is there anything wonderful in a magnet being able to attract substances at a distance equal to its own length? Is it not, on the contrary, a thing of common occurrence? Why then should we consider it impossible for the magnet we inhabit to attract bodies on its own surface?

In "Fownes' Chemistry" (p. 94, 9th ed.) we find the following passage:—"Of late the march of the daily variations of declination has been carefully compared with

the positions of the sun as well as the moon at the corresponding period. This enquiry, suggested by General Sabine, and carried on for a number of years in several localities, has led to the remarkable result that these celestial bodies exert a definite influence upon the magnetic needle, and must therefore be considered as magnets, like the earth itself."

If, then, the moon, as a magnet, is capable of exerting a "definite influence" at a mean distance of 237,000 miles from the earth,—if the sun, as a magnet, can manifest its power at a mean distance of 94½ millions of miles from our globe, we are driven to the conclusion that magnetism is a force which like gravity itself, though of a much more feeble character, is common to all bodies existing in space, and is capable of being exerted at immense distances.

It may be said that if the celestial bodies act as magnets on each other, certain oscillations and other changes in the relative position of the various planets, &c., would be from time to time produced, which could not be explained by the action of gravity alone, in union with the centrifugal force. Such changes, indeed, compared with those produced by gravitation, would be of a minute and trifling character; and the fact, therefore, that they have not hitherto been recognised, is no proof that they do not exist.—I am, &c.

JOHN A. R. NEWLANDS, F.C.S.

THE BRITISH SEAWEED COMPANY.

To the Editor of the Chemical News.

SIR,—There is a slight error in your correspondent's notice of our case in the Paris Exhibition, which please permit me to correct.

"No. 2, from Bardarrig is at present sold for bleaching," this should be *blacking*.

No thorough scientific examination of the acid, basic, and neutral products of the destructive distillation of seaweed has yet been made; these have been under investigation for some time, but the well known difficulty of completely separating these interesting bodies in a state of purity has long delayed the publication of results.

I may state, however, that the products of distillation, as well as the charcoal from this source, in their chemical composition present little analogy with those of wood, peat or coal, and can only be chemically classed with those of bone.—I am, &c.,

EDW. C. C. STANFORD.

Glasgow, July 30, 1867.

OZONE.

To the Editor of the Chemical News.

SIR,—The following are the more salient points in the development of atmospheric ozone during the past three months:—

In April there was a marked period of ozone from the 4th to the 11th. Considerable amounts were present from the 1st to the 3rd, and on the 14th, 15th, and 21st. No ozone was found on the morning of the 18th, and very little on the 12th, 16th, 17th, aft. of 22nd, 23rd, 25th, and 27th to the 29th.

In May there were marked periods of ozone on the 14th, and 15th, and 25th. Considerable quantities were present on the 4th, 16th, 21st, 27th, and 28th. No ozone was found on the 10th, 20th, and 30th, and very little from the 1st to the 3rd, 6th to the 13th, 17th to the 26th, and 29th to the 31st.

In June there were two marked periods of ozone—the first from the 4th to the 8th, and the second from the 24th to the 28th. Considerable amounts were found on the 2nd, 12th, 20th, and 21st. Very little on the monings of the 3rd, 10th, 13th, 14th, 16th, 18th, 19th, 22nd, 25th, 29th, and 30th, and throughout the day on the 27th.—I am, &c.,

R. C. C. LIPPINCOTT.

Bournemouth.

GAS FROM CHARCOAL.

To the Editor of the Chemical News.

SIR,—Your correspondent "G. L.," in No. 372 of your journal, asserts that I have been anticipated by Drs. Blumstrett and Reichardt in my discovery of the fact that the gas is nitrogen which escapes from recently ignited charcoal when immersed in water,—in answer to which I would desire to advise "G. L." that a notice of the receipt of my paper appeared in your journal for December 7, 1866. Allowing, therefore, for the length of time required for the transmission of postal information from here to your office, it will be perceived that not only was it impossible I could acquaint myself with the researches of these chemists, but that were I so inclined, I might reasonably contend for priority of discovery.

One question I beg to be allowed to ask of "G. L.," being unable as yet to examine the periodical alluded to,—Have Drs. Blumsrett and Reichardt proved—as I have—that *incandescent* charcoal absorbs nitrogen from the air?

Thanking your correspondent for his information in regard to my paper on "Soluble Vegetable Fibre," and for his courtesy throughout, but taking exception to the application of such terms as innumerable and exhaustive to the description of the researches of *any one*, however distinguished.—I am, &c.

WILLIAM SKEY.

Wellington, New Zealand, May 17, 1867.

MISCELLANEOUS.

Intercolonial Exhibition, 1866-7.—The shadow of the Paris Exhibition has, it is true, obscured somewhat the *eclat* of the similar event of the Southern World, but the history of the latter is well worthy of a short record. A few months ago, the Governor of Victoria publicly received the report of the jurors, and formally declared their awards at Melbourne. Up to the middle of February the number of admissions had been 242,892, which speaks well for the interest taken by the inhabitants of a thinly inhabited district in their national undertaking. A few notices of these awards will give a very fair notion of the character of this Exhibition, and will serve as a basis for comparison between it and similar European festivals. The public spirit shown in the Southern hemisphere cannot be mistaken, for it is most probable that this national work will remain as a permanent exhibition, while in England at the present time no decided step has been taken to secure any of the marvels of the Paris Exhibition for the public, the more valuable of which have already been bespoken by foreign governments. The most interesting department of course is that of the ores and non-metallic products, in which medals are allotted for nuggets, ingots, and granulated samples of gold and silver auriferous quartz and colonial gems. Antimony was exhibited in abundance, and native copper of a very superior character. Mr. G. Milner Stephens, F.R.S., received a medal for gems and precious stones; tin-ore, slate, and limestone, were exhibited, but by far the greatest interest is attached to the coal from Newcastle (neither upon Tyne, nor under Lyne), the shale from the Hartley Kerosene Oil and Paraffin Company, and the kerosene from the Western Kerosene Oil Company. Similar shales were sent from New SouthWales and Tasmania, also coals from both; from the latter country also the most valuable topazes were sent. South Australia carries off the palm for the following valuable minerals: copper ores, bismuth, plumbago, cobalt and its ores. The ores from Western Australia, for which medals are awarded, were copper only. New Zealand produces, in common with the other colonies, gold and coals, with plumbago and *Titaniferous iron ore*, with novelties in the way of chromium ores and alum. The absence of all mention of platinum would lead us to the conclusion that it is almost the only metal of commercial importance not found plentifully

in Australia. The chemical products, when contrasted with the brilliancy of the preceding, are rather meagre, the leading items for which medals are awarded, being "a beautiful sample of higher tarascaci," colonial soft soap, and fluid magnesia. Several awards were made for photographic chemicals, one for commercial mineral acids from Victoria, two for colonial made ink, these with Moulder's coal-dust colonial made ink, and fine quality blackings, exhaust the products for which awards were made in this section of "Chemical and Metallurgical Products and Processes." In the section for horns, hoofs, bones, &c., we notice stearine candles, silicated soaps, anti-corrosive composition for ships' bottoms, superphosphate of lime, deodorising powder, Victorian guanos. The native oils and waxes possess a special interest, with sperm oil, black whale oil, spermaceti, &c. In another department many medals were given for preserved meats, and essence of beef, chiefly from New South Wales. Of general interest will be the awards of medals to Mr. Allport for salmon two years old, smolt and perch, to the Acclimatization Society for the Angola goats, alpacas, and llamas: we mention these especially to show the spirit that exists in the colony. The following are prepared in Australia now also—formerly imported from foreign countries—arrow-root, coffee, and spices in great abundance, starch, maizena, granulated potatoes, "a very valuable article for long voyages;" maccaroni and vermicelli are also commended as a good specimen of a new industry. The Netherlands India Society received medals for tea, coffee, nutmegs, and cloves. New Caledonia is very ably represented, thanks to the exertions of the eminent scientific workers, who have prepared specimens of gluten, starch, and sugar, from the various native plants of that colony. A separate class is formed for chemical and philosophical apparatus. We might prolong this notice to an indefinite length, but will allude only to the sections for native wines and liqueurs, glass manufacture, and photography, with photographs of the Aborigines. In conclusion, we may add that the interest taken by neighbouring States in it, has given to this Melbourne Exhibition quite an international character; every one of our Australian colonies exhibited, and products were also sent from the Mauritius and the French settlement of New Caledonia. The Australian Maraschino, brandy, Hermitage, and Burgundy, may perhaps attract attention even at Paris, where one of the best conducted English departments is imported directly from Melbourne; we allude to that of Messrs. Spiers and Pond, who, as recognized representatives of England at Paris, bear witness to the rapid strides in civilisation made by our Australian colonies.

"Artificial Gold."—The following alloy, "artificial gold," as it is called, has been lately the subject of correspondence in the *Mining Journal* &c., and is hailed as a grand discovery likely to serve the Cornish copper and tin mines, by introducing a new demand for these metals. The description here quoted is from the *Engineer*, of July 19, 1867, as follows:—"It is stated that an American has discovered a beautiful alloy, which has been most successfully applied as a substitute for gold; it is composed of pure copper, 100 parts; pure tin, 17 parts; magnesia, 6 parts; tartar of commerce, 9 parts; sal ammoniac, 3·6 parts; and quicklime, 1·6 part. The copper is first melted, then the lime, magnesia, sal ammoniac, and tartar are added, little at a time, and the whole is briskly stirred for about half-an-hour, so as to mix thoroughly, after which the tin is thrown on the surface in small grains, stirring until entirely fused. The crucible is now covered, and the fusion kept up for about thirty-five minutes, when the dross is skimmed off, and the alloy found ready ready for use. It is quite malleable and ductile, and may be drawn, stamped, chased, beaten into powder, or into leaves, like gold-leaf. In all of which conditions it is not distinguishable from gold even by good judges, except by its inferior weight. The alloy has already been largely applied in the United States, and requires only to be known in Great Britain to become a favourite."

The Metric System.—Interpretation of the Act of 1864.—During the past year a subject of some importance, involving the legal construction of the Metric Act of 1864, was brought to the notice of the Board of Trade. One of the inspectors of weights and measures for the county of Surrey stated that he had seized some metric weights in a tradesman's shop in Southwark, as being illegal. On his bringing the matter before the magistrates at the Newington Sessions House, the defendants alleged that the Metric Weights and Measures Act, 1864, 27 & 28 Vict. c. 117., permitted the use of metric weights, but gave the inspector no power to examine them. The magistrates dismissed the information, observing that the Act was loosely drawn, and they advised the inspector not to seize the metric weights, as the defendants were justified under the Act in using them. Upon this subject the Board of Trade directed a case to be prepared for the opinion of the law officers, who gave their opinion that, notwithstanding the provisions of the Metric Act, a person *using* material metric weights and measures is liable to have them seized, and to conviction and forfeiture of the weights, under the Act 5 & 6 Will. iv. c. 63.

Pharmaceutists and the Jury Lists.—We have been requested to remind members of the Pharmaceutical Society, and others who may be entitled to claim exemption from serving on juries, that the churchwardens and overseers receive, during the month of July, the precept to return lists of persons qualified to serve on juries for the ensuing year; and that in August such lists are prepared and affixed to the church doors, &c. Pharmaceutical chemists should see that their names are not inserted in such lists, and, if inserted, should attend on the day of appeal and present their legal certificate of registration and exemption; such certificate may be obtained from the registrar of the Pharmaceutical Society, 17, Bloomsbury Square, on payment of 1s.

Quekett Microscopical Club.—The second annual general meeting was held in the library of university college on Friday the 26th ult. Mr. Ernest Hart, President, in the chair. The report of the committee showed that the society now numbers 273 members, of whom 130 were elected during the year; that many papers of microscopic interest had been read, field excursions successfully carried out, and class instruction in the uses of the microscope afforded to the younger members. The treasurer's report gave a satisfactory balance and in every way the club was in a very prosperous state. The president delivered an address, in the course of which he congratulated the members on the remarkable success which had attended the operations of the year, and on papers having been read which would bear comparison with those of any other club. He urged the members to remember that the microscope was not only a source of amusement but an instrument of research, and it was its real use which ought rather to be cultivated. Amusement and research were not incompatible, and the contemplation of minute forms was in itself a means of recreation, but the true microscopist is he who looks through form and structure to discover uses and laws, who is never contented with endeavouring to ascertain what are its relations, merely with a view to systematizing, but as a means to an end. Whether we consider the study of the microscope as an intellectual amusement or look into it as teaching some of the very highest truths relating to law, order and power in the universe, we yield only to the convictions which are taught us whilst looking upon structure in relation to the causes which modify it. The following officers were elected for the ensuing year:—President, Mr. Arthur E. Durham, F.L.S. Vice-Presidents—Dr. Tilbury Fox, M.R.C.P.; Mr. Ernest Hart; Mr. William Hislop, F.R.A.S.; Mr. John K. Lord, F.Z.S.; Treasurer—Mr. Robert Hardwicke, F.L.S.;—Hon. Secretary—Mr. Witham M. Bywater.;—Hon. Secretary for foreign correspondence—Mr. M. C. Cooke;—Committee.—Mr. W. J. Arnold, Mr. N. Burgess, M. S. J. McIntire, Mr. J. Slade.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Monatsbericht der königlich-Preussischen Akademie der Wissenchaften. December, 1866.

Ehrenberg "Contributions to the Knowledge of the Formation of Organic Siliceous Deposits."

January, 1867.

Baeyer "On the Effect of Age on the Length and Coefficient of Expansion of Iron and Zinc Metrical Standards."

Kunst and Gewerbeblatt. February 1867.

O. Reinsch "On Colouring thin Sheets of Metal, and rendering Membranes, Fabrics, and Glass Iridescent." A. Vogel "On the Assimilation of Silica by Plants." H. Vohl "On the Poisoning of Bread by the Use of Old Building Timber and Railway Sleepers for Heating Bakers' Ovens." A. L. Trenn "On a Substitute for Urine for Washing Wool."

No. 3. March.

E. Zeigler "On the Preparation of a Substitute for Animal Charcoal." H. Avet "On the Production of Printing Surfaces by Photography." C. H. Schmidt "On the Water Supply of Ludwigsburg." Paris Exhibition of 1867: Catalogue of Bavarian Products. "On the Use of Turpentine tor Whitening Household Linen," "On the Electrolytic Deposition of a bright Laver of Silver." F. F. Kuckla "Apparatus for testing the Inflamability of Petroleum." J. Fuchs "On the Use of Glycerine for impregnating Casks for holding Oil, Petroleum, and Turpentine." "Receipt for Copying Ink." "On Water Glass as an Ingredient for Cement."

Bulletin de La Société d'Encouragement. February, 1867,

Chatin "Report on Mauban's Thermometer for ascertaining Temperatures at Different Depths." Paris "On the Manufacture of Articles of Enamelled Iron." "C. Lauth "On the Manufacture of Aniline Black." Bon "On the Mannfacture of artificial Precious Stones." Guesnier "A Method of Producing Castings having an External Coating of Hard Iron." Guiot "A Thermoscopic Barometer." Havrez "An Improved Lixivating Apparatus." Lacroix "On the Manufacture of Colours for Painting on Glass." "On a dangerous Adulteration of Petroleum."

Journal fur Praktische Chemie. March 28, 1867.

G. Nadler and V. Merz "On Chinoline Blue." F. Holm "On Hæmatoidine." "G. Stadeler "On the colouring Matter of the Yolk of Egg." F. Holm "On the Chemical Constituents of the Suprarenal Capsulses." W. Dypkowsky "On the Identity of Choline with Neurine." L. S. Ioelstrom "On some new Minerals from Wermland and Oerebro." Bottger "Experiments with Mialaret Becknell's Constant Battery." Bottger "On the Action of Water on Metallic Lead." G. Streit "On the Preparation of Carbonate of Thallium.

PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

1212. E. Guenin, Henrietta Street, Covent Garden, Middlesex, "Improvements in the preparation and application of mustard for curative purposes." A communication from P. Rigollot, Paris. Petition recorded April 26, 1867.

1549. C. Sanderson, Worksop, Nottinghamshire, "Improvements in the manufaeture or melting of cast steel."—May 24, 1867.

1583. W Mitchell, Northwold, near Brandon, Norfolk, "An improved food for sheep and other animals."—May 28, 1867.

1628. A. G. Schaeffer, Gloucester-street, Newcastle-on-Tyne, "Improvements in obtaining increased light in the combination of illuminating mattera."—June 1, 1867.

1635. W. H. Richardson, Glasgow, N.B., "Certain improvements iu the manufacture of iron and steel, and in the means or apparatus for effecting the same."—June 3, 1867.

1646 E. Meldrum, Bathgate, Linlithgow, N.B., "Improvements in the purification of paraffine."—June 4, 1867.

1655. G. White, Queen Street, Cheapside, London, "Improvements in the manufacture of hydrate and carbonates of soda."—A communication from F. Blan, Turin, Italy.—June 5, 1867.

NOTICES TO PROCEED.

325. J. Wright, and T. Cobley, Copthall Court, Throgmorton-street, London, "Improvementa in the treatment of ores of lead for the purpose of obtaining salts and colours of the samh.

337, J. Graham, Manchester Road, Warrington, Lancashire, "Improvements in the manufacture of spelter from zinc ashes and refuses, obtained when cooting iron with zinc." Petition recorded, February 6, 1867.

344. G. E. Pain, High Street, Camden Town, and C. Corry, Dean Street, Soho, Middlesex, "Improvements in the preparation of oils for luminoting, lubricating, and other purposes for which they may be applicable." Februarr 7, 1867.

1412. H. A. Bonneville, Rue du Mont Thabor, Paris, "An improvde washing powder." A communication from L. Lacalm, and B. A. Gayot, Aubin, France.—Petition recorded May 13, 1867.

NOTES AND QUERIES.

Stearic Acid in Paraffin.—Sir,—Is there a test for the presence of stearic acid in paraffin ?—X.

Oxidation of Aniline.—Sir,—I should feel obliged to any of your readers who would give me the name and formula for the crystals resulting from the action of bichromate of potash on an acid solution of sulphate of aniline.—$C_{12}H_7N$.

Wires for Micrometers.—Sir,—If any of your ingenious readers can suggest anything which can be used for the purpose of micrometer wires for the microscope, they will confer a favour on the undersigned. At present spider threads, fine platinum wire, and diamond marks on glass are used, but they are all open to objections.—O. Ramsbottom.

Nitrogen.—Sir,—I require absolutely pure nitrogen gas for some experiments. I have instituted a few trials of different methods which appear likely to be successful, but it has occurred to me that, perhaps, a few lines from one of your correspondents may save me the trouble of further investigation. I may state that the purpose for which I require the nitrogen makes me anxious not to prepare it from air. Is there any way of liberating it from a solution or mixture so that the amount and velocity of the supply may be varied at will ?—Theta.

Hardening Steel.—Sir,—It has recently been mentioned that file makers at Sheffield prefer, for hardening their steel goods, water that has been for a long time in use. They say "old water hardens much better than new water;" and amongst the acts occasionally indulged in by workmen against their employers, that of making a hole in the hardening tank and letting the water run away, is considered to inflict injury for some considerable time. Is there any foundation for this opinion ?—A Sheffield Blade.

Commercial Testing of Aniline Colours.—Sir,—The ordinary method of determining the value of these colours, viz., dyeing swatches of equal weight and of equal quantities of the various samples in question, is quite satisfactory for reds and blues, but fails completely for purples, violets, and all intermediate shades. The reason is that these colours, instead of being homogenous, are now frequently made by mixing an ordinary "magenta" with *bleu de Lyons* in the required proportions, or, in other cases, by adding to a violet or purple colour a little magenta or aniline blue, to alter the shade according to wish. Now, a mixed colour of this kind may dye a swatch in the most satisfactory manner, but when used in the large scale the goods first put into the pan and those entered last will have quite different shades, owing to the unequal affinities of the colours for the fibre, and to their different behaviour with the other substances present. The method which I employ to determine whether an aniline violet is homogenous or a mere mixture, is the successive application of different solvents. Thus a sample of this nature was treated with hot water and filtered. The filtrate exactly resembled a solution of common magenta in hot water, and gave a worsted the colour which such a solution would produce. The residue, insoluble in water, was then dissolved in alcohol, and was found to be an ordinary aniline blue. If a mixed colour is dissolved in spirit and diluted with water, a drop of the liquid let fall upon white blotting paper will exhibit concentric rings of colours.—W.

ANSWERS TO CORRESPONDENTS.

Pharmaceutist.—The substance is incorrectly described as *crystallised*. It is a scaled preparation, to which that term is inapplicable.

Lombardy.—Consult any elementary book on chemistry.

M. Meller.—The mineral kindly forwarded by our correspondent unfortunately contains no trace of thallium.

J. W.—Add shellac to the solution of india rubber in naphtha—that will confer on it the desired property.

A Constant Reader.—From what we can gather from your long and involved statement, you have not been careful enough to remove free mineral acids from your solution. This has prevented the complete precipitation of the phosphate, and some having consequently passed through, has complicated the subsequent reactions. You can easily test the correctness of your supposition by trying whether the precipitate which ought to be yttria contains phosphoric acid.

Beta.—The alkaline stearates are very slightly soluble in water.

J. Maxwell.—Use a bath of tin, to which bismuth has been added, until its melting point is reduced to about 439F, cover the bath with paraffin to prevent oxidation (powdered charcoal is of no use), and watch the indications of a thermometer immersed in the melted metal.

Laputa.—A mixture of tallow and black-lead is very effectual as a lubricant for gas taps and metallic rubbing surfaces in general.

J. Jellick.—Leaf-gold is generally about 1-250,000th of an inch in thickness.

C. Charles.—Water your gravel walk with a solution of sulphate of iron, this will in all probability improve its colour.

Letters are waiting at our office for "J. C.," W. P. Meaden, "Manufacturer," "F. G. H.," and "Alpha."

Communications have been received from J. Carter Bell (with enclosure); William Skey, ditto; H. S. Bethell; F. Maxwell Lyte; the Abbé Moigno; Professor Heaton; F. Tomlinson; J. Heath (with enclosure); W. Edmonds; Rev. B. W. Gibsone (with enclosure); H. Watts, F.R.S.; A. P. Hurlstone; F. Foord (with enclosure); G. Marrison, Tasmania (with enclosure); F. Day; C. Tomlinson, F.R.S.; F. Avelino Aramayo; C. R. A. Wright; J. Sutherland (with enclosure); James Carruthers; James Owen; May and Baker; Professor G. C. Foster; J. Spiller; J. W. Slatter (with enclosure); Messrs. Townsend and Adams, New York (with enclosure); W. W. Renny; J. Henderson, jnr.; P. Anderson J. A. Lake Gloag; E. C. C Stanford; John Dods (with enclosure); R. F. Bright; E. Brembridge; Benjamin Wheeler; G. W. Wigner; John Lundy (with enclosure).

SUPPLEMENT
TO THE
CHEMICAL NEWS.
Vol. XVI., No. 400.

REPORTS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

ON THE ABSORPTION OF GASES BY METALS.

By Dr. ODLING, F.R.S., &c.

(Concluded from p. 35).

You observe in the case of all the metals we have as yet considered, that they are characterised by absorbing chiefly one particular gas. Platinum and palladium are characterised by absorbing hydrogen alone; and copper also, by absorbing hydrogen. Whether it absorbs any other gases has not, I believe, been determined. In the case of gold, the gas absorbed most abundantly is hydrogen, though it is certainly capable of absorbing a great many others. Now, with regard to silver, we find that it has the special property of absorbing oxygen gas. I am not referring to the temporary absorption of oxygen by melted silver, and its evolution on the solidification of the metal, which constitutes the well-known spitting of silver, but to the occlusion of the gas by the solid metal—for it is not merely an absorption, it is an occlusion, the metal retaining the gas for any length of time; and you will remember that, when speaking of platinum, I mentioned that the metal retained its hydrogen for two months, although exposed freely to the air. In different experiments, then, silver wire was found to absorb 74 per cent of oxygen, and nearly 21 per cent of hydrogen. Silver sponge absorbed 722 per cent of oxygen; 92 per cent of hydrogen; 52 per cent of carbonic acid, and 15 per cent. of carbonic oxide. A specimen of silver leaf exposed to the air at a red heat absorbed 137 per cent of oxygen and 20 per cent of nitrogen. Accordingly, while ordinary atmospheric air contains 21 per cent of oxygen, and the air absorbed by gold only 5 per cent of oxygen, in the air absorbed by silver the oxygen amounts to 85 per cent.

Now we come to another metal, and one of very great interest in relation to this occlusion of gases—namely, iron. Ordinary iron wire was carefully cleaned, heated in vacuo to drive off its natural gas, and then charged with different gases at a red heat. It was found that the wire, treated in this way, absorbed 46 per cent of hydrogen; but there was another gas which it could absorb in a much larger proportion—namely, carbonic oxide. Just as platinum is distinguished by its copious absorption of hydrogen, and silver by its absorption of oxygen, so is iron distinguished by its ready absorption of carbonic oxide. Whereas it absorbed only 46 per cent of hydrogen, it actually absorbed 415 per cent of carbonic oxide.

A point of interest connected with iron, as with platinum, is that the metal, though perfectly impervious to gas at ordinary temperature, yet when strongly heated, allows the passage through it of hydrogen gas, as shown by M. Deville, and of carbonic oxide, as shown more especially by Mr. Graham, whose admirable elucidation of the nature of these transmissions, forms the subject of our consideration this evening; and who has shown that in the case of iron, as in that of platinum, the transmission of the gas is preceded by its absorption in the substance of the metal.

With regard to the natural gas of iron wire,—that is to say, the gas existing in the metal as ordinarily met with,—I may direct your attention to the particulars of one or two experiments. In one experiment, the wire heated in vacuo was found to give off 7·94, which we will call 8 times its volume of gas, while in another experiment, in which the heating process was kept up for a much longer time, it gave off 12 times its volume, or 1200 per cent of natural gas, consisting chiefly of carbonic oxide. Whence it would appear that ordinary wrought iron occludes in the forge, and continuously retains, from 8 to 12 times its own volume of natural gas.

Now iron has two distinct origins. In addition to what we may call terrestrial or telluric iron, there is another kind of iron which we may call sidereal, that is to say the iron of meteorites. Hence it became a question of interest to ascertain whether this meteoric iron contained any gas, and if so, what was the nature of the gas; because it would appear, from the existence in the different metals examined of what may be called natural gas, that every metal contains a residue of the gas in which it last existed at a temperature of ignition. If the metal has been last ignited in hydrogen it retains hydrogen, if the metal has been last ignited in carbonic oxide it retains carbonic oxide. Does meteoric iron then contain any gas? and if so, of what kind? For the purpose of ascertaining these points, a quantity of meteoric iron from the Lenarto fall, of about 45 grammes by weight, and six cubic centimètres by volume, was taken, cleaned, and introduced into a porcelain tube of this kind. A vacuum was made in the tube, and heat then applied, when so soon as the meteorite got red-hot, it began to give off some gas; and here, in this repetition of the experiment, I hope to show you some of the gas which this meteorite has brought down from—who can say where. There we have the porcelain tube, containing the meteorite, exhausted by the air-pump and being heated by the furnace. One end of the tube is closed; the other end connected as you see with the Sprengel pump. The mercury is now falling in the Sprengel pump, and as it falls is delivering the gas. In this test-tube we are now collecting the gas extracted from the meteorite, and which the meteorite has brought down from the place where it last was at the temperature of ignition.

Now comes the question, what is the nature of this gas? Well, the 45 grammes or 6 cubic centimètres of iron were ignited in this way for two hours and a half, and during those two hours and a half, they gave off 60½ cubic centimètres of gas, which I may say at once consisted substantially, not of carbonic oxide—the gas existing in terrestrial iron which has been last ignited in a coal furnace—but it consisted substantially of hydrogen, or contained, at any rate, 85½ per cent of that gas, with a small quantity of carbonic oxide and nitrogen. Whereas, then, telluric iron contains carbonic oxide absorbed from the atmosphere in which it has been last ignited, this sidereal iron contains hydrogen instead, absorbed, I suppose, from the atmosphere in which it has been last ignited. My distinguished friend, Dr. Miller, in co-operation with Mr. Huggins, has demonstrated the existence of hydrogen gas in celestial bodies by an analysis of the spectra of several of the stars; but we have got, in this test-tube, the thing itself. Here is the free hydrogen gas which has been brought down to us by one of these smaller stars. Perhaps a point of still further interest, relating to this subject, is the classification of the stars according to their spectra, which Father Secchi has recently made. He has divided the fixed stars into three classes, in one of which, typified by α Lyræ, the spectrum is essentially the spectrum of hydrogen. That star, then, undoubtedly contains an atmosphere, of which the prevailing constituent is hydrogen gas. Now, upon a subject of this kind, which is only three days old, it is not in human nature to avoid speculating a little; and I think we may venture to speculate thus far, that our meteoric iron probably absorbed its hydrogen from a star-atmosphere of the class which is so typified.

But there is another point bearing upon this subject. Under ordinary circumstances, we are not capable of getting into iron more than half its volume of hydrogen; but this natural iron contains nearly three times its volume of hydrogen. Now, if under ordinary atmospheric pres-

sure, iron will absorb only half its volume of hydrogen, what sort of a pressure would it require to enable it to absorb six times that quantity? According to our present notions, it must at any rate have been exposed to an atmosphere in a very condensed state. We can not imagine that, in the interplanetary space of our ordinary solar system, there should be gas of a sufficient density to permit the absorption by this meteorite of six times the quantity of hydrogen absorbable by iron under the pressure of our telluric atmosphere.

We have now succeeded in extracting a considerable volume, many cubic centimètres, of gas from our ignited meteorite. I almost think, although the experiment is but a small one, that, as we have hydrogen brought from so great a distance for our examination, it is worth while to darken the theatre in order to witness its combustion; and having lowered the theatre-gas, we will now inflame our hydrogen of the stars. [The meteoric hydrogen was accordingly ignited.]

So much, then, for the great fact of the absorption and occlusion of different gases by metals. Now we have to consider what is the nature of the absorption. In the year 1823, Mr. Faraday established the general proposition that a gas was nothing else than the vapour of a volatile liquid, existing at a temperature considerably above the boiling point of the liquid. In the case, for instance, of liquid water, which boils at 100°, if the vapour of this water be afterwards heated up to a temperature of 150°, the water-vapour existing at the temperature of 150° is a true gas, possessing all the physical properties of a gas. If we take this water-gas existing at 150°, and cool it down to a little above the temperature of 100°, it loses some of the characteristic properties of a gas, and becomes what we more strictly call a vapour; and this vapour, if subjected to a temperature ever so little below 100°, at once becomes converted into liquid water. Accordingly, the boiling part of liquid water may be equally well called the condensing point of water-gas; and similarly, in the case of other gases, their respective condensing points are merely the boiling points of the liquids producing them. But the boiling point of a liquid, and the condensing point of its gas, is not a fixed point of temperature, but is a point of temperature varying with the pressure to which the gas or liquid is subjected. For instance, under ordinary atmospheric pressure, water boils at 100°, but, under the pressure of five atmospheres it boils at 150°, so, that if we take our water-gas existing at 150°, and maintaining its temperature at 150°, then subject it to a pressure of five atmospheres, its temperature will no longer be above the temperature of its boiling point, and it will cease to exist as a gas at all, and become converted into liquid water. Accordingly, we may effect the condensation of water-gas, existing at any temperature, by cooling it down to its ordinary condensing point, or by subjecting it to a degree of pressure at which its existing temperature will not exceed that of its thereby heightened condensing point. And so with other gases. Every one of the very many different gases known to chemists, with about six exceptions, has been condensed into the liquid state, by a certain reduction of temperature; or by a certain increase of pressure; or by a conjoint reduction of temperature and increase of pressure, until the temperature of the gas has been brought below the heightened condensing point or boiling point corresponding to the increased pressure.

Now let us consider more minutely, for a minute or two, the effect of pressure upon these condensable gases, taking water-gas as an illustration. Suppose we take water-gas existing at 150°, and contained in a cylinder closed in by a movable piston, which is balanced, or weightless. Supposing the area of the piston to be one square inch, the water gas is subjected to a single atmospheric pressure, which is equivalent in this case to 15lb. Now if we place a 15lb. weight upon the piston, we shall double the pressure, and consequently halve the volume of our water-gas. In order to reduce this gas to one-fifth of its original volume, we shall have to quintuple the original pressure, by placing four such weights upon the piston. But at a pressure of five atmospheres the temperature of the gas, or 150°, would cease to be above the temperature of its condensing point; and the gas, instead of being merely compressed into one-fifth of its original volume, would cease to exist as gas at all, but become converted into a scarcely appreciable volume of liquid, and the piston would descend to the very bottom of the cylinder. Accordingly water-gas at 150°, being condensable by a pressure of five atmospheres, it is impossible to reduce it to one-fifth of its bulk without liquefying it. And, similarly, with other gases. Ordinary ammonia gas being, at ordinary temperatures, condensable by a pressure of seven atmospheres, it is impossible to reduce it to one-seventh of its volume without liquefying it. Take, again, the case of sulphuretted hydrogen gas. That being condensable at ordinary temperatures, under a pressure of 15 atmospheres, it is impossible to reduce it to one-fifteenth of its bulk without liquefying it. Hydrochloric acid gas being condensable at ordinary temperature by a pressure of 40 times the ordinary atmospheric pressure, it is impossible to compress this gas into one-fortieth of its bulk without reducing it to the liquid state. And, in general, a gas maintained at some definite temperature, can not be reduced to a bulk less than that corresponding to the pressure necessary to liquefy it, without its becoming liquefied. Conversely, the reduction of any gas to a bulk less than that corresponding to the pressure necessary to liquefy it, must be taken as evidence of its liquefaction.

Now, although oxygen and hydrogen gases have never yet been reduced to their liquid state by mere pressure, there is strong reason to believe that these and other gases, absorbed by heated metals, really exist as liquids, or, at any rate, do not exist as gases within the substance of the absorbing metals. For these two gases have never been reduced to less than $\frac{1}{800}$th of their bulk by mere pressure, but when absorbed by massive iron, platinum, &c., they are seemingly reduced in bulk many thousand-fold. Moreover, all gases, even the most insoluble, are certainly liquefiable by solution. Here I have an experiment arranged to show the liquefaction of gases by solution and absorption, with a view to suggest the analogy subsisting between the absorption of gases by liquids and by heated metals. This sealed tube is filled with ammonia gas, and on breaking the end of the tube under coloured water, you observe that the gas is absorbed in an instant, the water rushing up to the very top of the tube. Now ammonia is one of the most soluble of all known gases, but, notwithstanding its great and rapid absorption, which you have just witnessed, it is in reality less soluble in, or absorbable by water, than hydrogen is absorbable by palladium. At mean temperature one volume of water absorbs about 780 volumes of ammonia, whereas one volume of palladium absorbs 643 volumes of hydrogen measured at 17·5, which would exceed 800 volumes measured at 97°, the temperature of the experiment.

Now, this absorption of soluble gases is manifested, not only in the case of liquids, but also in the case of soft solids; those which Mr. Graham has denominated "colloids." Accordingly, if we take a little hard white of egg, a substance which is not wet in the ordinary sense of the word, and if we pass it up into ammonia gas, you see that the white of egg absorbs the ammonia gas with almost as much rapidity as did water itself. Now one possible view, in connection with the absorption of gases by heated metals, is that these metals are in what may be termed a colloid state—that is to say, that they are soft bodies, or imperfect solids, and that a species of low form of chemical action takes place between the metal and the gas, allied somewhat to the low form of chemical action which leads to solution, or to the absorption of gas by soft solids, such as white of egg and india-rubber.

There is one further point to which, in the few minutes that remain to me, I wish to draw your attention, and

that is the absorption of gases by such substances as charcoal, for it is a question whether the absorption of gases by heated metals may not be allied in some degree to this well-known phenomenon; and certainly there are some facts, at any rate, which seem to indicate a very close relationship between the two acts of absorption. If we take a piece of compact charcoal, and pass it under metallic mercury into a cylinder of ammonia gas, we see in this case a somewhat rapid absorption of the gas; and I have no doubt that, in the course of a few minutes, the piece of charcoal will absorb the whole of the gas originally existing in the cylinder. Now, we know that this absorption of gas by charcoal varies considerably with the temperature of an experiment, the nature of the gas, and above all with the texture of the charcoal employed, just as does the absorption of gas by metal. Thus, in the case of platinum, the fused metal absorbs but a very small quantity of hydrogen, the spongy metal absorbs a larger, but still a comparatively small proportion; whilst the feebly porous metal, in the form of wrought platinum, alone manifests the property of absorption in the highest degree. Again, it is well known that the gases absorbed into charcoal have their chemical properties intensified, just as I have shown you with regard to the hydrogen absorbed by palladium. Further, the property of charcoal to absorb different gases is intimately related to its property of exerting a selective absorption of liquids and dissolved substances. Now we find this property also manifested by palladium. Thus 1,000 volumes of palladium foil were found to absorb 1 volume of water, 5¼ volumes of alcohol, and 1¼ volumes of ether, results showing a special relation of palladium to those different liquids, corresponding to the action manifested by charcoal. Moreover, this selective absorption of different liquids by a sort of capillary affinity, brings the absorption of gases by palladium into relation with some very familiar phenomena, at first sight of a widely different character, namely, the selective absorption of dyes by different tissues, and the action of mordants; the property which charcoal has of abstracting various matters from solution, being closely allied to that by which certain tissues and mordants abstract colouring matter.

There are many other points of very considerable interest, in relation to this subject, which I should be glad to bring before you, were not my time already expired; but there is one point of practical importance, connected with the absorption of gases by iron, which I ought not to omit, namely, the bearing which these facts have upon the conversion of iron into steel. Steel is manufactured, as we all know, by the application of charcoal to bar-iron at a certain temperature. The charcoal, it is true, gets partly converted into carbonic acid and carbonic oxide, but it is only the surface of the iron which is in contact with either the charcoal or its oxides; nevertheless the conversion of the metal into steel takes place through its entire mass. Now, it has hitherto been a subject of great difficulty to explain this penetration of the carbon, or carbon-oxides, into the centre of the iron bars. But we now see that iron, like a colloid or porous substance, has the power of absorbing carbonic oxide gas to its very centre. And it would seem that the process of acieration—the conversion of iron into steel—really consists in an absorption of carbonic oxide by the metal, and a subsequent decomposition of the absorbed carbonic oxide, into carbon, which effects the conversion of iron into steel, and into carbonic acid gas, which escapes from the surface of the metal, and gives rise to the blisters by which freshly made steel is characterised. The eliminated carbonic acid then takes up more carbon, to become reconverted into carbonic oxide, which the metal again absorbs, and so on continuously until the process is completed.

In conclusion, it only remains for me to express what I am sure we must all feel—our sense of indebtedness to Mr. Graham for his admirable investigations, which have not only added largely to our knowledge of the transmission of hydrogen through ignited platinum and iron, observed by M. Deville, but have gone very far to explain the nature of the phenomena, by showing that they differ altogether in character from the phenomena of diffusion, but are preceded by an occlusion and probable liquefaction of the gas in the substance of the metal, somewhat similar to the occlusion of soluble gases by water, or of absorbable gases by charcoal, in virtue, probably, of a low form of chemical affinity subsisting between the gas and the metal. They have brought to light the startling fact of the occlusion of some of the lightest gases by some of the heaviest metals, to the extent of several times their volume, and, in the case of palladium, to the extent of several hundred times its volume. They promise, moreover, to throw great light upon a very important branch of manufacturing art—namely, the conversion of iron into steel. They have also given us a new illustration of the strange relationship so frequently existing between apparently the most remote phenomena, as the acieration of a piece of iron and the dyeing of a piece of silk. And, lastly, in the case of the meteoric iron, they have afforded us a further demonstration of the oneness of the universe, of the extension of one chemical system throughout the entire cosmos.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Ammoniacal Cobalt-bases, Modes of Formation of.—C. D. Braun. 1. To a solution of cobaltic chloride or nitrate is added solid ammonic chloride and aqueous ammonia, the mixture is well shaken, plumbic peroxide added, and the whole boiled for half-an-hour. The solution then contains chiefly hexammonio-cobaltic chloride, which is precipitated in crystals on addition of chlorhydric acid.

2. A moderately strong solution of cobaltic nitrate is well shaken with strong ammonia, pure indigo-blue (prepared according to Fritzsche's method) added, and the mixture boiled; on cooling crystals of pentammonio-cobaltic chloride are obtained.

3. Tetrammonio-cobaltic oxychloride, hexammonio-cobaltic chloride, and aqueous ammonia, heated together under pressure, form pentammonio-chloride, according to the following equation:—

$$(A = NH_3)$$

$$3\left\{\begin{matrix}Co_2A_4\\Cl_3\end{matrix}\right\} + \left\{\begin{matrix}Co_2A_4\\Cl\end{matrix}\right\}\Theta + 4\begin{matrix}Co_2A_6\\Cl_3\end{matrix} = 8\begin{matrix}Co_2A_5\\Cl_3\end{matrix} + \begin{matrix}Co_2A_5\\Co_2A_5\end{matrix}O_3$$

4. The reaction, by which from tetrammonio-oxychloride plus chlorhydric acid, is obtained hexa- and pentammonio salt (Schiff, Fremy) the author explains by the following two equations, the first representing the action of strong chlorhydric acid, the second that of diluted:—

$$\text{I.}\quad 4\left\{\begin{matrix}Co_2A_4\\Cl_3\end{matrix}\right\} + \left\{\begin{matrix}Co_2A_4\\Cl\end{matrix}\right\}\Theta + 2HCl = 4\begin{matrix}Co_2A_5\\Cl_3\end{matrix} + 2\begin{matrix}Co_2A_5\\Cl_3\end{matrix} + Co_4O_3 + H_2O$$

$$\text{II.}\quad 10\left\{\begin{matrix}Co_2A_4\\Cl_3\end{matrix}\right\} + \left\{\begin{matrix}Co_2A_4\\Cl\end{matrix}\right\}\Theta + 2HCl = 10\begin{matrix}Co_2A_6\\Cl_3\end{matrix} + 4\begin{matrix}Co_2A_5\\Cl_3\end{matrix} + 3Co_4O_3 + H_2O$$

5. Penta- and hexammonio compounds may also be obtained by acting upon xantocobaltic salts with strong ammonia, or by dissolving in them ammonic chloride and heating.—(*Ann. Chem. Pharm.*, cxlii. 50).

Toluolsulphurous Acid.—R. Otto and O. V. Gruber. Toluolsulphurous acid ($C_7H_8SO_2$) according to these,

is prepared by acting upon sulphotoluolic chloride in ethylic or benzolic solution with sodium-amalgam, and decomposing the sodic salt, thus formed, with chlorhydric acid. It crystallises from water in large, white, rhombic plates, resembling benzoic acid; dissolves readily in alcohol, ether, or benzol; fuses at 85°, and decomposes above 100°. Exposure to moist air converts it into toluolsulphuric acid

$$(C_7H_8SO_3)$$

The salts of toluolsulphurous acid are crystallisable and mostly soluble in hot water or alcohol; its ethylic ether is an oily liquid.

Bromine substitutes an atom of hydrogen, forming bromsulphotoluol

$$\left.\begin{matrix} C_7H_7 \\ SO_2 \\ Br \end{matrix}\right\}$$

Chlorine acts in a like manner, furnishing a chloride identical with that obtained in the ordinary manner (from phosphoric chloride and sodic sulphotoluolate), and giving with nascent hydrogen Märker's metabenzylsulphhydrate.—(*Ann. Chem. Pharm.*, cxlii., 92.)

Argentic Hydrates.—C. Weltzein. Silver dissolves in a neutral solution of hydric peroxide with disengagement of oxygen and formation of a small quantity of a blueish gray precipitate. The solution contains argentous hydrate ($Ag_2=216$), and is not precipitated by sulphuretted hydrogen nor immediately by chlorhydric acid; the precipitate formed after some time consists of a mixture of chloride and metallic silver; potassic hydrate produces a dark brown precipitate. When left exposed to air, the solution assumes a reddish brown colour, and becomes turbid from silver being separated. When evaporated to dryness and extracted with water, a residue of metallic silver is left, and a solution obtained which now contains argentic hydrate ($Ag=108$). This solution has a slightly alkaline reaction, and is at once precipitated with chlorhydric acid. The nature of these reactions is shown in the following equations:—

I. $2Ag_2+H_2O_2=2HAg_2O$

II. $2HAg_2O=2HAgO+Ag_2$

III. $2HAg_2O+2HCl=2H_2O+2AgCl+Ag_2$.

(*Am. Chem. Pharm.* cxlii. 105).

Oxidation of Alcohol.—C. F. Schönbein. The presence of certain hydrocarbons in alcohol greatly accelerates the oxidation of the latter. When absolute alcohol is mixed with pure oil of turpentine, or a similar substance, and exposed to sunlight and atmospheric oxygen, hydric peroxide is soon formed. The nature of this process the author believes to be this:—The hydrocarbon polarises the oxygen of the air, that is to say, causes it to split up into $\overset{-}{O}$ and $\overset{+}{O}$. $\overset{-}{O}$ is used for the formation of resin, formic acid, etc., and $\overset{+}{O}$ combines on the one hand with the hydrocarbon, forming a compound similar in constitution to hydric peroxide; on the other, oxidises the alcohol, forming hydric peroxide.—(*Journ. pr. Chem.*, c. 469).

Oil of Bitter Almonds, combination with Acetic Anhydride.—Hübner. The researches of Limpricht and of Neuhof have proved the identity of diacetic benzol, derived from benzoylic chloride and argentic acetate, with the compound obtained from chlorinated toluol; but it remained to be decided whether this compound is also identical or only isomeric with the body, first obtained by Geuther from oil of bitter almonds and acetic anhydride, the latter having been obtained as an oil, differing in that respect from the true diacetic benzol which crystallises readily. Hübner has repeated Geuther's experiments, and confirmed the latter chemist's statements, but adds, that the smallest fragment of a crystal of diacetic benzol brought in contact with the oil, causes it to crystallise immediately, and after several recrystallisations from ether it shows the melting point (44°—45°), and all other properties of diacetic benzol $C_7H_6(C_2H_3O_2)_2$.—(*Zeitschr. Ch.* N.F. iii. 277).

Pyrrol, Preparation and Oxidation of.—M. Goldschmidt prepares pyrrol by heating ammonic mucate with glycerine in a retort to 180°—200°. At that temperature the decomposition of the mucate into ammonic carbonate and pyrrol takes place with great regularity. This method is likewise preferable to that of dry distillation, on account of the larger quantity and superior quality of the product obtained. Pyrrol reduces argentic oxide, being converted thereby into a well defined acid which is soluble in water, alcohol, or ether, forms precipitates with silver and lead, and sublimes in needles.—(*Zeitschr. Ch.* N.F. iii. 280.)

Gallic acid, Bromo-derivatives of.—M. E. Grimaux. Bromine substitutes readily one or two atoms of hydrogen in gallic acid, forming mono- and di-bromgallic acid = $C_7H_5BrO_5$ and $C_7H_4Br_2O_5$. Both are readily soluble in boiling, sparingly in cold water, soluble in alcohol and in ether.—(*Comptes R.* lxiv. 976.)

Tantalum, Atomic Weight and Compounds of.—R. Hermann believes the composition of tantalic chloride to be $TaCl_2$, for with this assumption the vapour-density, as found by Deville, 9·6 agrees with the calculation, which requires 9·66. The atomic weight of tantalum based upon this formula is 860. To these considerations is added a compilation of all known compounds of tantalum, including several new ones, in regard to which the reader is referred to the original paper.—(*Journ. Pract. Chem.* c. 385.)

Toluol, Chloro-derivatives of.—O. Pieper. Toluol, saturated with chlorine, separates on standing crystals of the composition $C_7H_6Cl_8$. They fuse at 150°, are insoluble in water, sparingly soluble in alcohol, more so in ether, but they dissolve readily in carbonic bisulphide. Sodic hydrate in alcoholic solution decomposes the new compound readily at 110°, and on adding water to the product of decomposition a brown oil separates, the aqueous solution containing small quantities of an acid which seems to be dichlordracylic acid, $C_7H_4Cl_2O_2$. The oil after purification is colorless, distils at 280°—290°, and has the composition $C_7H_4Cl_4$.—(*Ann. Chem. Pharm.* cxlii. 304.)

Specular Iron made at Biber (Hepia), and used, with great success, for the production of cast steel cannons, being dissolved by electrolysis in hydrochloric acid, was found to contain (according to Bagh) the following substances:—

Carbon	3·758
Iron	87·997
Manganese	6·555
Phosphorus	0·578
Silicon	0·497
Sulphur	0·171
Calcium	0·127
Copper	0·120
Arsenic	0·118
Magnesium	0·052
Antimony	0·027
Silver, lead, bismuth, ...	trace.

—*Ann. d. Chem. u. Pharm*, bd. 140, p. 180.

Blast Furnace.—To increase the production of iron blast furnaces six-fold, Morgan gives them greater dimensions; for instance, 9½ mètres in diameter, blowing into the furnace by 12 tuyeres. A hollow cone is besides constructed in the middle part of the bottom of the furnace, by means of which a blast is also introduced into the furnace.—*Revue Univers. X.* ann., 4 livr., p. 62.

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THE CHEMICAL NEWS.

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ON THE ANALYSIS OF CAST IRON.

By EDMUND G. TOSH, Ph.D.

Before proceeding with the regular analysis of cast iron, I have examined some of the more important processes for the estimation of the numerous substances which make up its constitution. The analysis of cast iron is one of the more difficult operations of analytical chemistry, and to ensure accuracy many special precautions and much extra manipulation are necessary—not because the ingredients are of themselves difficult of determination, but because the quantity of iron in every case preponderates so largely over that of the other elements.

In comparing the merits of the various processes one specimen of iron was used throughout.

Estimation of Carbon.—The estimation of this element as it occurs in iron is a problem which has engaged the attention of many celebrated chemists. Connected with the literature of the subject we find the names of Berzelius, Karsten, Wöhler, Gay-Lussac, Regnault, Caron, and numerous others, but notwithstanding the labour which has been expended in this direction, we have not arrived at a method which does not necessitate a large amount of time and work for its satisfactory accomplishment.

a. Regnault's method,* with the modifications of Bromeis, † is thus carried out. About two inches of a combustion tube of hard Bohemian glass, closed at one end, are filled with a mixture of equal parts of chromate of lead and chlorate of potash. 3 grms. of the iron under examination, in a state of very fine division, are intimately incorporated with 50 grms. of a mixture of 40 parts of chromate of lead, and 6 parts of previously fused chlorate of potash, and introduced into the combustion tube, and lastly a layer of chromate of lead. To the tube a chloride of calcium and a Liebig's potash apparatus are attached; the former to retain traces of moisture, the latter to absorb the carbonic acid formed. The combustion tube is cautiously heated, first near the open end as in the conduction of organic analysis. When the mixture of the iron with the lead salt is brought to a dull red heat, the metal burns with incandescence, and the carbon is oxidised to carbonic acid, which is absorbed by the potash solution. At the close of the operation the mixture at the extreme end of the tube is heated, oxygen is evolved, all carbonic acid is driven forward, and the last traces of carbon consumed. From the increase of weight of the potash apparatus, due to carbonic acid, the amount of carbon may be calculated. In this way Regnault obtained very concordant results, which were afterwards confirmed by the experiments of Bromeis. I made two estimations by this process, and the results agree well with one another.

1. 3·240 grms. of iron gave 0·462 grm. CO_2 equal to 3·886 per cent of carbon.
2. 3·8245 grms. of iron gave 0·5605 grm. CO_2 equal to 3·996 per cent of carbon.

I have reason to think, however, that the percentage of carbon indicated, is somewhat too low in both cases, on account of loss of carbon during pulverisation of the iron. This loss, as pointed out by Morfit and Booth,‡ is often appreciable, and in the case of highly graphitic iron, very considerable. With this one exception, the process is in every respect commendable, and where, as with spiegeleisen or white iron, this loss of carbon cannot take place, it strongly recommends itself. When instead of a mixture of chromate of lead and chlorate of potash, chromate of lead is used alone, no very reliable results can be obtained, and invariably the amount of carbon shown by this method is too small.

b. Fresenius's Method.‖—A weighed portion of the metal, in borings or chippings, is dissolved in dilute sulphuric acid by the aid of heat. The gases evolved during solution, consisting mostly of hydrogen, are passed over red-hot oxide of copper. The gaseous hydrocarbons are burned, and the carbonic acid formed, after drying by chloride of calcium, is absorbed by potash solution in a Liebig's apparatus, and thus weighed. Fresenius states that in cases where the percentage of combined carbon is very low, this process may be used for its direct estimation. Where an estimation of the total carbon is required, the matter insoluble in the dilute sulphuric acid, remaining behind in the flask, is collected and burned in a stream of oxygen, and from the weight of the resulting carbonic acid, the amount of carbon may be deduced. This quantity, added to that obtained by burning the gases over oxide of copper, gives the total quantity of carbon contained in the iron. In drying the insoluble residue previous to combustion in oxygen, an elevated temperature must be carefully avoided, as I have occasionally noticed that at a temperature of about 100° C., this insoluble matter gives off a strong-smelling, disagreeable vapour, in all probability a volatile hydrocarbon, formed by the contact of hydrogen and carbon in the nascent state. At a temperature of about 80° C. the odour evolved is very slight, and the loss inconsiderable, but the safest way is to dry over sulphuric acid. The presence of hydrocarbons in the graphitic residue, at once shows that this process could not be safely applied in the present case for the estimation of combined carbon directly. The following experiments illustrate the same point.

1. 1·42425 grms. iron dissolved in dilute sulphuric acid, and gases evolved passed over oxide of copper, gave 0·2525 grm. CO_2 = 0·4834 per cent carbon.
2. 1·62425 grm. iron treated in the same manner gave 0·01625 grm. CO_2 = 0·2728 per cent carbon.

The insoluble residues in both cases were collected and burned in oxygen.

From 1 gave 0·1964 grm. CO_2 = 3·7612 + 0·4834 = 4·2446 per cent carbon.

From 2 gave 0·2319 grm. CO_2 = 3·894 + 0·2728 = 4·1168 per cent carbon.

The deficiency in the amount of carbon in the gases in No 2 is made up by the larger quantity in the insoluble matter.

This method requires a large amount of time for its execution, the apparatus is somewhat complicated, and the great number of operations which the carbon must go through render the exercise of extreme care more than usually necessary.

I would here remark, that in all my experiments I found the perfect combustion of graphite, even in oxygen, required a very high temperature. In my first trials, I sought to burn graphite at a dull red heat in a tube of hard Bohemian glass, but it remained almost unaffected in a stream of oxygen. I found it most convenient to place the graphite first in a platinum boat, insert this into a well-glazed porcelain tube, and expose to a full red heat in a small charcoal furnace. In a gentle steam of oxygen the carbon is perfectly burned in a few minutes, and the resulting carbonic acid is absorbed in the usual way by potash solution.

(To be continued.)

* *Ann. d. Chem. u. Pharm.* xxx. p. 352.

† *Ann. d. Chem. u. Pharm.* xliii. p. 241.

‡ *Chemical Gazette*, vol. xi.

‖ *Zeit. Anal. Chem.* iv. 69.

ON THE

UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

(Continued from page 56).

Coal-Tar Colours.

I will now make a few remarks on the processes which are followed for the production of coal-tar colours. Most of them are derived from the naphtha which is sold as 40 per cent benzole, which is a mixture of benzole and toluole with a little xylole. The first step of the process is to convert the constituents of this naphtha into the corresponding nitro-compounds, by carefully mixing it with fuming nitric acid or with a mixture of two parts of common nitric acid and one sulphuric. The reaction is very violent if the temperature is not controlled; but, with proper management, the three hydrocarbons lose each an equivalent of hydrogen to a like proportion of oxygen in the nitric acid, and gain the residual peroxide of nitrogen. Thus:—

$$\underbrace{C_{12}H_6}_{\text{Benzole.}}+HNO_6=\underbrace{C_{12}H_5NO_4}_{\text{Nitrobenzole}}+2HO$$

$$\underbrace{C_{14}H_8}_{\text{Toluole.}}+HNO_6=\underbrace{C_{12}H_7NO_4}_{\text{Nitrotoluole.}}+2HO$$

$$\underbrace{C_{16}H_{10}}_{\text{Xylole.}}+HNO_6=\underbrace{C_{16}H_9NO_4}_{\text{Nitroxylole.}}+2HO$$

These three nitro-compounds constitute the dark amber-coloured, oily liquid which floats upon the acid; and when it is separated from the acid and washed with water, and then with a weak solution of carbonate of soda, it constitutes the crude nitrobenzole which is used for the manufacture of aniline colours.

It has a strong odour of bitter almonds, is heavier than water, and is very soluble in alcohol and ether. If this crude nitrobenzole be submitted to the action of a reducing agent, each of the nitro-compounds will lose its four equivalents of oxygen, and gain two of hydrogen, and be thereby converted into a corresponding alkaloid, thus:—

$$\underbrace{C_{12}H_5NO_4}_{\text{Nirobenzole.}}+6H=\underbrace{C_{12}H_7N}_{\text{Aniline.}}+4HO$$

$$\underbrace{C_{14}H_9NO_4}_{\text{Nitrotoluole.}}+6H=\underbrace{C_{14}H_9N}_{\text{Toluidine.}}+4HO$$

$$\underbrace{C_{16}H_9NO_4}_{\text{Nitroxylole.}}+6H=\underbrace{C_{16}H_{11}N}_{\text{Xylidine.}}+4HO$$

This process of reduction may be effected by sulphide of ammonium (Zinin's method), or by the nascent hydrogen evolved when zinc is treated with dilute sulphuric acid (Hofmann's method), or by acting on the nitro-compounds with iron and acetic acid (Bechamps' process). I show you here an experimental illustration of each of these processes, and you will observe that for lecture experiment the process of Hofmann is the most striking, but in practice the method of Bechamps is the most economical.

One hundred parts of the crude nitrobenzole is mixed with nearly its own weight of strong acetic acid, and to this is added little by little about 150 parts of iron turnings. The mixture is generally made in an iron retort, and after being well stirred it becomes hot, and soon forms a pasty mass of oxide of iron with an acetate of aniline and the other bases. The reactions are somewhat intricate, but they may be practically expressed thus—

$$\underbrace{C_{12}H_4NO_4}_{\text{Nitrobenzole.}}+4Fe+2HO=\underbrace{C_{12}H_7N}_{\text{Aniline.}}+2(Fe_2O_3)$$

And the same for the other nitro-compounds, so that theoretically the acetic acid should act indefinitely.

The mixture is then submitted to heat until the retort is nearly red hot, by which means impure aniline, &c., distils over, and when this is treated with a slight excess of lime or soda, and again distilled, it yields the crude aniline of commerce. The best product is obtained when the distillation is going on between the temperatures of 340° and 380°, for as the temperature rises to 626° two new alkaloids are produced, which Hofmann has named *paraniline* ($C_{24}H_{14}N_2$) and *xenylamine* ($C_{24}H_{11}N$).

Other processes have been suggested for the production of aniline and its homologues from the nitro-compounds; thus Kremer has recommended the use of finely powdered zinc; Wöhler, an alkaline solution of arsenious acid; Wagner, the ammoniacal solution of suboxide of copper; and Vohl, an alkaline solution of grape sugar; but none of these methods have taken the place of Bechamps.

The crude aniline of commerce, which is a mixture of aniline and toluidine, is more or less deeply coloured liquid of an amber tint; it is heavier than water, and it acquires a blue or red colour by various oxidizing agents. A solution of chloride of lime turns it, as we see, of a bluish-purple colour. It was this reaction which suggested the name of *kyanol*—blue oil. Acidulated with a mixture of equal parts of water and strong sulphuric acid, and treated with peroxide of manganese or peroxide of lead, it produces, as you observe, a rich blue. Chromic acid makes it, as you may see, of a green, a blue, or a black colour, according to the degree of oxidation; but the most remarkable experiment of all is the coloration of the aniline when it is acidulated with dilute sulphuric acid and submitted to the action of the galvanic battery. At the platinum pole, where oxygen is evolved, it instantly becomes bronze-green, then blue, then violet, and finally red; showing that the coloration of the alkaloid is due to the nascent oxygen, and that the tint corresponds to the degree of oxidation.

The crude aniline dissolves to some extent in water, but it is more freely soluble in alcohol and ether. It readily combines with acids, and forms crystalline compounds; hence it was called *crystalline* by Unverdorben, its discoverer. These salts become coloured on exposure to the air.

The production of colours from this liquid was the remarkable feature of the Exhibition of 1862. It dates from the year 1856, when Mr. Perkin discovered and patented the process for making a rich violet from aniline by means of bichromate of potash; but it is right to say that several chemists had long before noticed the fact that the salts of aniline were capable of producing rich colours. Runge, in 1835, obtained a violet blue by acting on one of the oily constituents of coal tar with chloride of lime. Five years afterwards Fritzsche observed the blue coloration of aniline with chromic acid, and the like thing was described by Beisenhirtz; but none of these reactions commanded attention until the year 1859, when Messrs. Guinon, Marnas, and Bonnet, of Lyons, introduced a new fast purple under the name of *French purple*, which they obtained from orchil, and which became a favourite and fashionable colour. The *mauve* of Mr. Perkin, which had been for three years before the public, was so much like it, that it rose suddenly into public favour. The year after, in 1859, M. Verguin, of the firm of Rénaud Brothers, of Lyons, obtained a brilliant red from the same base, and it was patented by them under the name of *fuchsine*. These two results commanded so much attention that the scientific and technical world entered very earnestly into the investigation with the view of discovering new processes of manufacture; and at the present time we have the means of making almost every variety of tint from coal-tar products. Most of these dyes are called aniline colours. but in truth they are produced from toluidine as well as aniline, and, as we shall see hereafter, they are obtained by processes of oxidation and substitution. They are generally classified under the heads of violets, reds, blues, greens, blacks, yellows, &c.

Violets.

These have received a variety of fanciful names, as *mauve*, *violine*, *rosolane*, *tyraline*, *indisine*, *harmaline*, *imperial violet*, *regina purple*, &c., &c.

The first of them was obtained in 1856 by Mr. Perkin, whose patent is dated the 26th of August of that year. His process is to add equivalent proportions of diluted solutions of a salt of aniline (generally the sulphate) and bichromate of potash. A good proportion is 2 parts by weight of aniline, 2 of bichromate of potash, and 1 of sulphuric acid of English commerce. The aniline and sulphuric acid are first mixed and then dissolved in water. To this solution is added the bichromate of potash, also previously dissolved in water, and after being well stirred they are allowed to remain quiet for 10 or 12 hours, when a dark-coloured sediment appears. This is to be collected upon a filter and well washed with cold water. It is then dried and treated with colourless coal-tar naphtha until all brown tarry and resinous matter is dissolved away. After this it is again dried and boiled in successive portions of alcohol or methylated spirit until the whole of the violet colouring matter is dissolved out. The spirit solutions are then distilled in order that the spirit may be recovered, and the residue is mauve, It amounts to only about 4 or 5 per cent in weight of the aniline used, but its tinctorial power is very great. In this condition it is not absolutely pure, although it is sufficiently so for common purposes. To purify it, it must be boiled in a large quantity of water, and the solution treated with an alkali. The colouring matter which precipitates is to be collected upon a filter, washed with water until all trace of alkali is removed, and then dissolved in spirit. If the spirituous solution be evaporated to dryness, the pure colouring matter remains as a beautiful bronze-like substance. It is hardly at all soluble in water, ether, or coal-tar naphtha; but it freely dissolves in spirit and in weak acids, especially acetic. Concentrated sulphuric acid dissolves it without decomposing it, and forms a dirty green solution, which becomes of a beautiful blue colour with a little water, and a violet or purple with a good deal. It is, therefore, a very permanent body, although it will not resist the action of chlorine or nitric acid. Reducing agents, as sulphide of ammonium or protosulphate of iron, change it to a brown-coloured solution, which re-acquires its violet tint on exposure to the air. Like most of the aniline dyes it forms a very insoluble coloured precipitate with tannin.

Other processes have been patented for making this colour; thus, Bolley, in 1858, Beale and Kirkham, in 1859, and Depouilly and Lauth, in 1860, patented the use of chloride of lime with a salt of aniline. These solutions, when used in proper proportions, produce an insoluble purple precipitate, which is the mauve of Perkin. It is purified by washing it with water slightly acidulated with sulphuric acid, then dissolving it in concentrated sulphuric acid, reprecipitating with water, washing it with water upon a filter, and lastly dissolving in spirit. In 1859 Mr. Kay patented a process for obtaining it by adding peroxide of manganese to a strong solution of sulphate of aniline, and keeping the mixture for some hours at the temperature of boiling water. The purple solution thus obtained is to be filtered and precipitated by adding ammonia until the acid is neutralised, and the precipitate, when collected upon a filter, washed with water, and then dissolved in spirit, forms the violet-coloured dye called *harmaline*. In the same year Mr. D. Price produced a patent for manufacturing the colour by means of peroxide of lead instead of peroxide of manganese, and Mr. Greville Williams obtained a patent for permanganate of potash. The year after (1860), there were several patents for it, as Mr. Stark's, with ferricyanide of potassium, and Messrs. Dale and Caro's, with perchloride of copper and chloride of sodium.

In the year 1861, Mr. Adam Girard observed that a purple colour could be obtained from aniline red by mixing it with its own weight of aniline and exposing it for several hours to a temperature of 350° Fahr., which is a little short of the boiling-point of aniline. The mixtures employed were equal parts of dry muriate of rosaniline and aniline, and the product, which is a reduced condition of aniline red, is washed with water slightly acidulated with muriatic acid until all the unacted on aniline and aniline red are removed, and the pure purple remains. This is dissolved in spirit or acetic acid, and forms the dye called *Imperial purple*. In the year following (1862), Mr. Nicholson obtained his patent for procuring the same colour by merely heating Magenta or aniline red to a temperature of from 390° to 420° Fahr. The substance first melts, and, after evolving ammonia, is changed into the purple which he named *Regina purple*.

(To be continued.)

NOTE ON THE CRYSTALLISATION AND THE SOLUBILITY OF PLUMBIC CHLORIDE.

By J. CARTER BELL, F.C.S.

The various manuals and dictionaries of chemistry, when speaking of plumbic chloride, fail to say anything on the phenomenon of its crystallisation; it is generally written that "it crystallises in brilliant needles." This state of crystallisation only occurs under certain conditions, for if pure plumbic chloride be taken and dissolved in boiling distilled water, and then allowed to cool, the chloride does not crystallise out "in brilliant needles," but in a sort of cuneiform or arrow-shaped crystals, which are not white but of a delicate cream colour, and in the many experiments I have performed, I have failed in producing white brilliant needles by this method. But if the solution contains free hydrochloric acid, then we obtain white needle-shaped crystals; and according to the amount of HCl present in the mother liquor, so will the crystals vary in size, colour, and shape. With a small per-centage of HCl, the crystals are white, and from 10 to 20 millimètres in length; if the HCl increases, very small white needles are obtained, and if it is strong HCl of 1·116 specific gravity, the crystals are no longer needle-shaped, but are of the form of the base of the right rhombic prism.

The Solubility of Plumbic Chloride.—A pure saturated solution of plumbic chloride at 16·5° Centigrade, contains ·9414 per cent of the chloride, being the mean of three experiments; the addition of HCl diminishes the solubility considerably, and up to a certain point, which I have not yet determined, it may be stated that as the HCl increases the solubility decreases.

	Per-centage of $PbCl_2$
Water containing 1 per cent of HCl (sp. gr. 1·116) at 16·5°C. only holds in solution	·3470
" " 2 " " "	·2013
" " 3 " " "	·1656
" " 4 " " "	·1459
" " 5 " " "	·1310
" " 6 " " "	·1078
" " 7 " " "	·1007
" " 8 " " "	·0991
" " 9 " " "	·0968
" " 10 " " "	·0931

A saturated solution of plumbic chloride in hydrochloric acid of specific gravity 1·116 at 16·5°C., contains 2·566 per cent of $PbCl_2$, but on the addition of water nearly the whole of the chloride is precipitated. These experiments seem to point that there must be a minimum hydrochloric solution of plumbic chloride, and also a maximum. Future experiments which I shall make will perhaps decide.

Manchester, July 29, 1867.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, AUG 6, 1867.

Meeting of the Society of Encouragement.—Writing inks.—Decoration of porcelain.—Steam machinery.—Industry of caoutchouc.—Reaction of oxygen on molten iron.—Researches on ozone.—Newton and Pascal.

THE Council of the Society of Encouragement held its periodical meeting in Paris on the 26th ult.; M. Dumas in the chair. MM. Robert and Theurer, watch and clock makers at Chaux-de-Fonds (Switzerland), laid before the society the drawings of their great repeating clockwork and winding apparatus for clocks and watches, an appendix to the communication made by them on the 12th July.

M. Becker, Rue-de-la-Glacière, 72, Paris, offered himself as a candidate for the prize founded by M. Alexandre for the improvement of writing inks, and handed in samples of his black and violet inks.

M. Besson, ceramic lithographer, made, in his name and that of M. Macé, porcelain manufacturer, a communication on the application of chromolithography to the decoration of porcelain. He showed how easy it was to transfer on porcelain and earthenware chromolithograpic pictures executed on paper with the colours and varnish adapted for painting on porcelain.

M. Duprez explained a contrivance, invented by him, for a more perfect distribution of steam by a variable detent acting without the aid of an excentric. In all slide valves with a single box, according to the extent of the admission, the opening of the port is more and more narrowed, and the exhaust ports are opened sooner. M. Duprez, avoids this inconvenience by the following means, the employment of which is particularly adapted for locomotives. The contrivance consists in a parallelogram fixed to the crosshead. In the model presented to the Society, the durations of the admission and the compression are sensibly the same (at equal detents), as with the much employed system of the link valve reversed; but the new system gives the ports a greater opening by 45 per cent. An analogous combination, admitting a toothed wheel forming an epicycloidal, gives similar results, and is peculiarly adapted to stationary engines.

Mr. Balard placed before the Society the progress of the industry of caoutchouc during the last few years. Commerce has furnished, in fact, 9,000 tons of caoutchouc, the value of which is 40,000,000 francs in a raw state, and 75 to 80,000,000 francs in a manufactured state. One half of this quantity, and the purest, has come from the province of Para. The industrial demands are so important, that experiments have been made in Brazil for cultivating the tree which produces this substance, in the same way as the quinquina has been grown in the Himalaya. It is extensively used for waterproof clothing, boot soles, cards for wool, &c.; in the cards where much suppleness is required, the purest material from Para alone is used. The processes of vulcanising have also been perfected. The employment, for this purpose, of the chloride of sulphur, has become general; it has been employed either alone or dissolved in sulphide of carbon; the employment of litharge for neutralising the hydrochloric acid or moderating the sulphuration, has been better regulated. The temperature of 135°C., at which the vulcanisation takes place, has been rendered more fixed and certain by substituting, for the ordinary boiler, currents of steam. Cords of vulcanised caoutchouc are made of the pure materials, masticated with extreme care in small masses, which are kneaded together so as to form a homogeneous mass, the vulcanisation being effected by steeping the packets in water heated to a constant temperature of 135°C.

M. Troost, Professor of Chemistry, called the attention of the Society to the results obtained by properly treating cast iron at a high temperature with a current of oxygen gas. This experiment, made in 1855, by M. Henry Saint-Claire Deville, is the starting point of all the researches subsequently made. It gives the means of easily obtaining Bessemer steel, or, if it be required, a very pure soft iron. M. Troost repeated his experiments before the assembly. The cast-iron, placed in a crucible of quicklime, is fused by the combustion of a mixture of hydrogen and oxygen gases. In this state, and by increasing the emission of oxygen, the carbon, silicium, and sulphur are burnt up, and form a dross which is absorbed by the substance of the crucible; the oxygen burns the iron itself, leaving the iron in a melted state, excellently pure.

From experiments carefully made, the hydrometric commission of Lyons has established since 1852 the habitual absence of ozone in the air of that town, while its presence is constantly evident in the exterior of the city. In the month of September, 1865, the Imperial Observatory caused the same studies to be made, on an extensive scale, over all France, with a view of discovering some law, if there is one, that would explain this phenomenon. The same reagent papers were remitted to all the stations, so that they might be rigorously compared together. The observations were taken during a whole year; the results of this immense work will be, perhaps, soon known to the world. Meanwhile, M. Fournet gives the conclusion arrived at by his resumed observations at Lyons and the suburbs, with the co-operation of M. Lambert and Rassinier. While ozone was very abundant at Sauvage, on the heights of Tararæ, a range of hills separating the basins of the Loire and Rhone, traces were barely perceptible once or twice a month at Lyons. It is well known that it has been often maintained that the arrival of the cholera was coincident with the disappearance of ozone in the air. The example of Lyons does not agree well with this assertion; this city is not subject to cholera, and, at the same time, its atmosphere is always deprived of oxygen.

The revelations of M. Chasles with respect to Pascal are the great topic of the day, and we wait here with impatience the news of its reception from the English press. M. Chasles is far from having furnished his last observations, as he has only placed before the public a small portion of his treasures. He is in possession of other documents which prove that Pascal had discovered before Newton, and even taught Newton, the admirable fact of the decomposition or the dispersion of light; that he was the first to make the celebrated experiment of the prism, to observe and number the seven principal colours of the solar spectrum.

The glory, also, of the employment of the word "differential," or "differential calculus" to distinguish it from the calculation of fluxions and fluents of analytical algebra properly so called, escaped Newton, to fall upon his adopted father Pascal. Newton will not cease to be considered as a great man, but the public will cease perhaps to believe in his genius and his good faith, when it will be known that at his earliest career he was in possession, through Lebnitz, of printed and manuscript documents of Kepler; through Viviani he had the MSS. of Galileo; by Pascal, the MSS. of Descartes, even those which were brought from Sweden after his death; these latter were sunk in the Seine along with the boat which carried them, and fished up again at the old quay of the Louvre; also by Pascal, Newton had his letters, notes, thoughts on attraction, the decomposition of light, the differential method, &c. When he had such a remarkably precious store, it is not surprising that he arrived at such wonderful results, but it is astonishing that he took so long a time to put these documents in practical use. Ah! if Pascal had had the time and leisure necessary to write in French the *Principia*, with what depth and clearness would he have developed his magnificent theme!

M. Chasles possesses also a letter in which Arnaud, grieved a little at the effect produced by the first of the "Provincial Letters" wrote a most interesting word of encouragement to Pascal.

F. MOIGNO.

REPORTS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

A COURSE OF FOUR LECTURES ON

SPECTRUM ANALYSIS,

WITH ITS APPLICATIONS TO ASTRONOMY.

By WILLIAM ALLEN MILLER, M.D., F.R.S., &c.

Lecture IV.

(Concluded from page 49).

Spectra of the Fixed Stars.—Mode of observation.—Double Stars.—Variable Stars.—Temporary Bright Star in Corona.—Nebulæ.—Clusters.—General Conclusions.

A great number of other stars have been examined. I cannot, however, attempt to give you any idea of their composition in detail, but must refer you to a list which you will see here, giving the names of the more important stars, which we have examined more or less completely. Among the most interesting of the stars we have examined are Sirius, Arcturus, Capella, Vega, Pollux, Castor, Cygni, Procyon, and α β and γ Andromedæ, Rigel, Spica Virginis, α Aquilæ, Cor Caroli, Regulus, and others. The general result of these investigations shows that the stars are bodies, formed upon the same plan as our sun, each differing in composition from its fellows, but all apparently containing matter, some portion of which is identical with that composing a part of our own globe.

One or two of these stars may be advantageously referred to more fully. Among these, a red star β Pegasi is much like the star α Orionis in its general character, but it is much fainter. It is one of the third magnitude. Here we have been able to measure only twenty lines. We can see that it is full of lines, but the uncertainty of the atmosphere and the difficulty of seeing these lines with precision have prevented us from accurately fixing the places of a larger number. It contains sodium and magnesium—two of the same bodies which are preseut in Aldebaran; and, besides that, it is probable, though we have not been able to verify all the principal lines, that barium, iron, and manganese are present.

Let me now call your attention to the colours which the stars exhibit. It is a matter of familiar observation that the stars differ in their tint. This difference appears to be caused in many cases by the atmosphere outside the photosphere, which causes an absorption of certain colours contained in their light, and in consequence of this we have a difference in the tint. It is remarkable that in some of the red or orange stars, like β Pegasi, and others, hydrogen is absent, whilst in the white stars this element is predominant. In the spectrum of the important star called Vega (α Lyræ), sodium, hydrogen, and iron have been found. It might be supposed that the star Sirius, the brightest of all the stars, would have given us more information than all the others; but it is not so. I will throw its spectrum upon the screen, and you will see that it is remarkable for the absence of strong lines. The light of Sirius is white. There are only three important lines in its spectrum, and these correspond exactly in position with the lines of hydrogen. With these exceptions, the lines of Sirius are feeble. I do not mean to say that there are not other bodies in the stars besides hydrogen, but the proportion of those other bodies must be so small, and the vapour so dilute, that the whiteness of the light is not subdued by them in any remarkable degree. Here are lines which correspond to F and C; here is a line in the blue; and here is one which we constantly find in all the stars, the double sodium line D. Here is the magnesium line; and here is one which is probably due to iron.

Let me now call your attention to the varieties in colour which the stars exhibit. Sirius, as I have said, is a white star. There are stars which have an orange, or yellow, or ruddy tint; and, again, there are others which are blue, or green, or purple.

The examination of these coloured stars is often a matter of great difficulty, because in general their luminosity is small, and frequently these coloured stars occur in pairs, constituting what are known as double stars. It often happens that a bright orange-coloured star has a faint blue or green star as its companion; and this companion is often so close that it is a matter of considerable difficulty to separate the spectra of the two stars, though we can see them in the telescope distinctly enough. In order to separate the spectra of two stars it is needful so to arrange the motions of the telescope that the spectra shall be always at right angles to the line joining the two stars, so as to maintain the two spectra parallel to prevent them from overlapping, and so interfering with one another. I will take first an orange-coloured star, the brighter of the double stars which constitute Herculis; in the spectrum of this star on the screen, you will see the orange and yellow predominating, whilst other portions of the light are subdued in consequence of the presence of a large quantity of absorbent matter, which stops certain rays in the blue and violet portions of the spectrum. You must bear in mind that in throwing these images upon the screen we are under a considerable disadvantage, because though they are tinted to give you an idea of the relative position which these lines occupy in the spectrum, they do not by any means represent with accuracy the colours which the star itself would show. You will see in the red part of the spectrum there are three or four strong lines, but in the orange and yellow there are comparatively few, so that this star shines with an orange light in consequence of the absorption of the green and blue portions.

I will now take one of the double stars, β Cygni, and project an image of the orange star, with its blue companion, on the screen. The orange star is the more brilliant one. The blue star is so faint upon the screen that you can hardly see it from a distance. You may imagine from this what is the difficulty in seeing, and still more in measuring the position of such faint lines as these. Let us now examine the spectra of the two stars. That of the orange star is characterised by a large number of bands or lines in the blue and green portions, and comparatively few in the yellow portions. In the spectrum of the blue star we have scarcely any lines in the blue, but a large number of lines in the yellow and orange, and in some parts of the red.

We have here, then, examined two classes of stars—some which have a considerable brilliancy, and others in which we have them varying in colour; but there are other variations in the stars, respecting which the spectroscope, we may hope, will at some time or other afford information. Some of the most remarkable amongst the stars are variable in their lustre. At times they shine out with a high brilliancy, and at others they become reduced and almost disappear from view. One of the most interesting problems demanding solution in the nature of stellar bodies, is the explanation of this singular periodical variation. Sometimes these periods are tolerably regular, occurring after a few days, or a few months, or sometimes after years. At other times the periodical variations in the star are irregular; that is to say, though the light of the star waxes and wanes in intensity, it does so at irregular intervals. One single observation seems to show, so far as it goes, that there is hope of further progress in this direction. The star α Orionis, one of the first whose spectra I projected on the screen, is a variable star. It is one, however, of which the variation is not very wide. It varies, perhaps, half a degree in magnitude. We found, on making observations when it was at its maximum, that a certain group of lines which were observed two years before, when it was at a low state of illumination, had disappeared. Their position had been carefully measured during a period of minimum, but these lines were not found when the star was at its maximum.

There are, however, others falling under this class of variable stars which are still more remarkable. They have been called temporary stars. One of the most prominent of these was noticed on November 7, 1572, when Tycho Brahé, in returning one evening from his observatory, saw persons gazing at a star which he knew was not visible half-an-hour before. It continued to increase in brightness for some weeks, but in the course of a year it gradually dwindled away. This star has been altogether lost sight of, and no one knows its true position. In October, 1604, a star equally bright appeared in Serpentarius. It almost rivalled Jupiter in brightness. It afterwards faded away and disappeared. In the year 1848 Mr. Hind observed a smaller star, in Ophiuchus, of a ruddy colour, which came out and disappeared in the same sort of way. Lately we have had an opportunity of watching one of these stars, which has thus blazed out, and rapidly died away. It was even more brief in its blazing forth, and more rapid in its disappearance, than any of the others; but, happily, at the moment the opportunity offered, we were prepared to examine its light by means of the spectroscope. Mr. Birmingham, of Tuam, first saw it in Ireland, on the 12th May, 1866. He informed my friend Mr. Huggins, who received the news of its presence on the 16th May, and by the same post, Mr. Baxendell, of Liverpool, directed his attention to the star. No time was lost. On the very same evening on which the intelligence arrived, as it happened to be a fine night, we directed the telescope to the spot, and we were able to discover a most remarkable state of things. I shall project on the screen the image of this star. It blazed forth in Corona. About the time Mr. Birmingham saw it it was of the second magnitude. It occupied the position of a star of the ninth or tenth magnitude noted by Argelander. You will observe that the spectrum of this star is crossed as usual by a number of black lines in the luminous coloured portions; but, besides that, you will see some very bright bands of light—four strong lines, and a fifth much fainter in the blue. We had never seen such lines in any solar or stellar observation before, and they are evidently connected with a new, and, as it turned out, a transient state of things. Two of these lines occupied the position of the lines of hydrogen. One corresponding to the line C in the solar spectrum, and another to the line F. There are two strong brilliant lines in the blue, the nature of which we were not able to ascertain. The duration of the outburst till it dwindled down to a star of the seventh or eighth magnitude, was but a week, so that the opportunities of making observations and measurements were but few. In this star, then, we have three different spectra. First, we have a photosphere giving out a continuous spectrum, and over that we have the usual state of the solar and stellar atmospheres—that is to say, an atmosphere filled with luminous vapours, capable of absorbing a part of the light behind; and then, outside that, more brilliant still, is a luminous spectrum of glowing gas, as though this star was suddenly involved in the flames of hydrogen, combining with some substance the nature of which we do not know, but which may be—probably is—connected with the two unexplained brilliant lines in the blue. I say this star, at the time of this outburst of light, was in a condition in which a sudden and violent action upon the hydrogen occurred, in consequence of which, probably, the whole mass of the star was raised in temperature, and its luminosity consequently was increased, but the temperature of the mass of the star was not brought up to the same point as the temperature of the hydrogen by which that incandescence appears to have been produced. What the origin of this hydrogen was of course it would be vain and idle to speculate, but the presence of hydrogen is certainly revealed by the observations just described. Moreover, the hydrogen must have been in a state of active incandescence which may be supposed to be the cause of the humidity of the star, and just as a glowing ball of lime is heated up in the nearly lightless flame of the oxyhydrogen jet, so the nucleus of this star was lighted up by an outburst of hydrogen suddenly brought to an intensely incandescent condition. It is clear that this observation could not have been made without the aid of the spectroscope, for on viewing a star through the telescope all that can be seen is limited to variations of colour and brilliancy; we can never magnify a star so as to produce anything more than a point of light. We can never get a disc. We have simply an increase in the intensity of the light as we increase our telescopic power. Among the most remarkable of the variable stars is η Argus, the spectrum of which seems to demand a careful study.

I must now pass on to a totally different series of objects—the *nebulæ*. Scattered over different parts of the heavens are a number of remarkable bodies which look like patches of light or luminous clouds. In some cases they are collected into rings; in others into spirals, whilst in other instances they assume still more definite forms. These nebulous masses of light have ever since their discovery excited in a high degree the wonder and curiosity of those who have examined them. The interest they awaken is perhaps still further increased by a remarkable speculation concerning them put forth by Sir William Herschel, when asked whether it was not possible that these nebulæ might be the primordial forms of matter from which stars and suns and their attendant planets had been produced. Notwithstanding minute and careful observations by the telescope nothing was known of the physical condition of the matter comprising these nebulæ. It was not even known whether they were aggregations of stars so infinitely distant from us that we could not discern the separate stars, or whether each nebula was a separate luminous object of a nature entirely different from the stars. Mr. Huggins has been enabled in several instances to show that the nebulæ are not stars, but that they are composed of glowing gas; and, farther than that, he has been enabled to give some hint as to what this gas may be. I must now ask you to look at the photographs of some of these bodies, which I shall throw upon the screen; many of them have been taken from the beautiful drawings of Lord Rosse. When Mr. Huggins was examining one of these nebulæ with his spectroscope for the first time, he observed what appeared to be a single vertical line of light, this on closer inspection was seen to be accompanied by two fainter lines in the more refrangible portion. This observation immediately gave him the key to the nature of these bodies. The first nebulæ that he examined was a comparatively brilliant one in Draco (37 H iv.). The nebulæ are usually referred to by letters and numbers, which represent the position of these bodies in certain catalogues drawn up by astronomers of eminence. This nebula in Draco, then, instead of giving a continuous spectrum, crossed by black lines like the stars, was found to give three lines of light only, and the greater part of the light was concentrated into one of these three lines. Indeed, had it not been for this circumstance, the light of the nebula is so excessively faint that it would have been impossible to see it at all as spread out in a continuous spectrum, and, in fact, my friend scarcely expected that it would be possible to get any accurate observation in consequence of the faintness of the light. The result, however, amply rewarded him for his trial. You observe upon the screen a spectrum consisting of three lines only. They are here exaggerated very greatly in brilliancy, for the purpose of rendering them visible at all. Below the representation of the spectrum of the nebula on the diagram are the bright lines which correspond most nearly with its lines. This line F corresponds exactly with the faintest of the three lines in the nebula. It is very difficult in diagrams of this kind to preserve the true relation in brilliancy of these lines to each other. At the less refrangible end there is no line corresponding to the red line of hydrogen. An important observation made by Plücker upon rarefied gases in tubes may have a bearing on this point. He found that as hydrogen becomes rarefied, its red line disappears. Hence the absence of the red hydrogen line in the nebula may be connected with the attenu-

ated condition of its gaseous materials. In the diagram you will see three other lines occurring in the solar spectrum. Those are lines which correspond to the group of magnesium lines. The brightest and most refrangible line in the spectrum of the nebula corresponds to one of the brightest lines of nitrogen. It is remarkable, however, that the other lines of nitrogen are absent. This second line in the nebular spectrum does not correspond to any of the lines that are known to us, but the newest known to it is one of the lines of barium. It must not be supposed that all the nebulæ are exactly like this one. Of the sixty which Mr. Huggins has examined, about twenty exhibit the bright lines due to matter in its gaseous state, all of which contain the bright line corresponding to that of nitrogen; in some the other fainter lines are not seen. Such spectra, therefore, are not produced by a group of stars; not by a substance like any others that we have seen hitherto in the heavens; they must be furnished by masses of glowing gas, which are giving out light of these three particular degrees of refrangibility.

Besides these true gaseous nebulæ there are a vast number of others, but in some of them the luminous material is connected in such a way that they appear in the telescope like clusters of minute stars, or they look as if condensed into little points of greater luminosity than others. Now, when such clusters are examined by the spectroscope they are found to furnish continuous spectra crossed in some cases by the same light lines produced by the nebulæ which are wholly gaseous, so that here the nebulæ appear to consist of two portions, one still gaseous, the other undergoing a sort of condensation. One dares hardly to speculate upon these matters in the present state of our knowledge. It is so easy to speculate and get wrong, and thus to fix notions in one's mind that it is not easy to get rid of again. The truly philosophical course here is simply to form such a hypothesis upon the facts observed as shall serve to guide us in our further investigations.

My friend, Mr. Huggins, has placed a large number of his beautiful drawings of nebulous bodies at my disposal. I can only select one or two for exhibition on the screen. There is a nebulæ which has a remarkable shape like that of the planet Saturn. All these nebulæ have a particular faint bluish green light. Here there are the same three lines. Here, again, is a remarkable spiral nebula (80 H iv.), which has been very carefully observed by Lord Rosse. You will see the style and character of its construction. But it is also remarkable for its brightness in comparison with some of the others. Besides the three lines previously noted we observe a further bright line which is more refrangible than the others. The gaseous character of this nebula is distinctly seen. I will now take a nebula which is not gaseous, and which is visible to the naked eye—the well-known nebula in Andromeda. There is a concentration of light in its nucleus around which is expanded into a longitudial form. It does not give a spectrum with bright lines, but a continuous spectrum with certain peculiarities. The orange and red portions are almost absent, and the other portion has a mottled appearance, which it is scarcely possible adequately to represent upon the screen. Here is a table which will give you an idea of the character of the nebulæ examined by Mr. Huggins, and the results of his observations compared with the purely telescopic observations of Lord Rosse, as furnished to Mr. Huggins by Lord Oxmantown:—

	Continuous spectrum.	Gaseous spectrum.
Clusters	10 ..	0
Resolved or Resolved? ..	5 ..	0
Resolvable or Resolvable? ..	10 ..	6
Blue or green, no resolvability, no resolvability seen	0 ..	4
	6 ..	5
	—	—
	31 ..	15
Not observed by Lord Rosse	10 ..	4
	— 41	— 19

Here are the results which were arrived at by Lord Rosse by observation with his colossal reflecting telescope. First of all are ten clusters, and amongst these clusters all give a continuous spectrum. None of them appear in the spectroscope to have a gaseous spectrum, so that the observations of the telescope and spectroscope correspond. The second line represents to us a certain class of bodies which, though they have not actually been resolved into separate stars as the others have been, yet appear to be resolved. None of the bodies exhibit gaseous spectra. On the other hand, amongst those which have a blue or green colour there are none which are not gaseous. Then there is a group which are not resolvable, some of which give a continuous spectrum and others a gaseous spectrum.

I have thus endeavoured, however imperfectly I have succeeded, but still so far as time and opportunity admitted, to bring before you some of these spectrum discoveries. The more we pursue studies of this matter the more is the mind carried forward with the desire for further knowledge. Whilst thus from time to time we are permitted to get fresh glimpses into the constitution of the universe, and to trace something more of the infinite mind which has designed the whole, so should we feel the more that we are bound to use the fresh knowledge thus placed at our disposal, not for the glory of man, but, as far as may be, for the glorifying Him who made all things and upholds all things by the word of His power.

ACADEMY OF SCIENCES.

JULY 29, 1867.

(FROM OUR OWN CORRESPONDENT.)

Pascal's letters forgeries.—Rain fall in Alsatia.—Experiments on Induction currents.—Surgicial instruments from Pompeii.

THE Abbé-Zantadeschi presented a copy of a work on the climate of Catania, the conclusions of which are that this country is one of the spots in Italy where the climate is most mild, and it is exactly the place where persons suffering from pulmonary complaints should be sent.

M. Faugére, sub-director of the Minister of Foreign Affairs, who had devoted his life to the subjects of the illustrious Pascal, and the history of his family, who had the good fortune to discover the several precious unpublished documents entitled "Pensées, fragments et lettres de Blaise Pascal," was struck with the account of the letters and notes presented and given to the Academy by M. Chasles; he wished to see these surprising autographs, and was convinced that the signature of the letters deposited by M. Chasles is not that of Pascal, but that they are simply forgeries. He requested the Academy to appoint a commission for as scrupulously as possible inquiring into the authenticity of these documents.

M. Chasles replied that he had no doubt whatever on the validity of the letters and notes presented by him, and that he hailed with pleasure the appointment of the commission demanded by M. Faugére. The members are MM. Chevreuil, president; Delaunay, V.P.; Elie de Beaumont and Coste, secretaries; Chasles, Duamel, Pouillet, Faye and Leverrier. M. Chasles disputed the assertion of M. Duhamel, "In admitting the authenticity of the letters deposited by M. Chasles, and supposing even that they had been published before the *Principia*, they would not give the right of priority to Pascal for the law of universal gravitation. The glory will ever rest with Newton." M. Chasles maintains, on the contrary, that the glory of the discovery, and the demonstration of universal attraction proportional to the masses is in the inverse ratio of the distance, belongs to the immortal Pascal. He proved by calling to mind the following of the letters and notes of the illustrious philosopher, and which will created a profound sensation in England.

M. Becquerel presented a note on the temperature of water currents, by M. Ch. Grad.

In two former communications he gave his researches on the fall of rain in Alsatia, and the relations which exist between the flow of water in the Ill, and the rainfall in its basin; to-day he submitted the result of the running waters in the same region. These observations, repeated twice a day, at 7 a.m. and 4 p.m. were made principally on the Fecht. The Fecht is a sort of torrential river, taking rise in the Hautes Vosges at a height of 3,300 feet above the level of the sea. The following are the comparisons made between the temperature of the water and that of the air:—The mean temperature of the water from July, 1866, to June, 1867, was found to be 10°·5 C. inferior, by 0°·8, that of the air at Turckheim. The difference between the temperature, maxima and minima, of the year was 23°.7. The greatest variation was during the month of May, 13°·3, and the greatest diurnal varation, 7°·6, occurred the 14th July. The amplitude of the oscillations is less for water than for air; the temperature of water attains its diurnal maximum and minimum only after the maximum and minimum of the air have been reached. In summer the rains lessen the temperature of the Fecht, and in winter it is raised. Also the range of variations was found to be more decided in summer than in winter; weaker under an overcast sky than in a clear one, and it becomes more pronounced according as we recede from the sources, with the increase of volume of the water-course. This last observation confirms those of M. A. Bertin on the temperature of the Ill at Strasbourg, and the Lower Rhine at the Kehl Bridge, as shown by the following results:—During the year 1858 to 1859, the average temperature of the air at Strasbourg was 10°·2C.; that at Kehl Bridge 10°· 5; the water of the Rhine at Kehl Bridge, 10°·9; the Ill at Strasbourg, 11°·2. These results give to the Ill and the Rhine a higher temperature than that of the Fecht; and this general law can be deduced, that in the *same region* the temperature of running waters increases with their volume.

M. Regnault presented, in the name of M. Blaserna, professor of the University of Palermo, results of experiments on the passage of induction currents. His conclusions are the following:—1. The time elapsed between the closing or the rupture of the circuit and the apparition of the current of induction, or the attraction of the armature for the bobbin of induction is inappreciable, less than the fiftieth part of a second. 2. The current of induction, feeble at its commencement, increases little by little, then diminishes, and is extinguished in an interval difficult to determine.

M. Elie de Beaumont gave official notice of the election of M. Wurtz in place of M. Pelouze, late master of the Paris Mint, and called upon him to take his chair.

Dr. Scoutteten, principal physician of the army of France, read a paper on the surgical instruments, probes, specula, &c., found in the ruins of Pompeii. He mentioned, especially, one instrument, a probe, presented by Gallien to a magistrate named Erastitrate, and which seems preferable, in a practical point of view, to those now in use.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Influence of a Current of Gas on the Decomposition of Compounds.—D. Gernez. When a current of an indifferent gas, as nitrogen, hydrogen, or air, passes through a solution of baric, calcic, or potassic bicarbonate, carbonic acid is given off; alcalic sulphhydrates under these conditions lose sulphuretted hydrogen, and acid sulphites and acetates are converted into neutral salts. These phenomena of decomposition are considered due to dissociation.—(*Comptes R.* lxiv. 606.)

Thallium-amalgam.—J. Regnauld. Thallium combines with mercury with evolution of heat, and the amalgam is electro-negative compared with thallium; this is a further proof of the fact that, whenever a metal dissolves in mercury and heat is given off, the metal is electro-positive in comparison with the amalgam.—(*Comptes R.* lxiv. 611.)

Propyle-benzol, Action of Bromine on.—E. Meusel. The action of bromine on cumol at ordinary temperature gives rise to the formation of two substitution-compounds, monobromcumol $C_9H_{11}Br$, boiling between 218° and 220°, and a crystalline compound of the composition $C_9H_7Br_5$, melting at 99°—100°. At high temperatures and in presence of water an acid has been obtained which has the composition of dibrombenzoic acid.—(*Zeitschr. Chem.* N. F. iii. 322.)

Phosphorous Acid, Action of Bromine and Iodine on.—G. Gustavson. Equal molecules of bromine and phosphorous acid act upon each other in sealed tubes at 100° and below, according to the following equation

$$PH_3O_3+Br_2=2HBr+\underbrace{BHO_3}$$

Metaphosphoric acid.

Four molecules of acid and three of bromine decompose in the following manner—

$$4PH_3O_3+3Br_2=3PH_3O_4+3HBr+PBr_3$$

Iodine combines less readily with phosphorous acid; the reaction between eight molecules of the latter and five of iodine takes place as follows:—

$$8PH_3O_3+5I=6PH_3O_4+2HI+PH_4I+PI_2$$

—(*Akad. Petersb.* xi. 299.)

Thallium.—Wöhler separates this metal from flue-dust in the following manner:—The material is repeatedly extracted with boiling water, slightly acidulated with sulphuric acid, and the filtrate, without previous concentration, precipitated with chlorhydric acid. The chloride is converted into sulphate, and the latter in aqueous solution reduced by zinc or by an electric current derived from a single cell: the metal is finally fused under a layer of potassic cyanide.*—(*Ann. Chem. Pharm.* cxlii. 263.)

Phosphorus, Combinations of.—H. Wichelhaus. The compound $PCl_2(OBr)$ has been obtained (*Menschutkin Ann. Ch. Ph.* 139, 343), by acting upon absolute alcohol with phosphoric terchloride, and substituting in the compound $PCl_2(OC_2H_5)$ thus formed, bromine for ethyle. The author has by means of this reaction, but employing chlorine instead of bromine, prepared the compound $PCl_2(OCl)$, which, he finds, is identical with the ordinary phosphoric oxychloride. This synthesis has some not unimportant consequences. It will be possible, starting from oxychloride or ethylephosphorous chloride, to prepare the compound $PO(C_2H_5)_3$ which, supposing it to be identical with the oxide of triethylephosphine, will thus prove the constitution of the latter to be analogous to phosphoric oxychloride—

$$P\{OCl,\ Cl,\ Cl\} \quad \text{and} \quad P\{OC_2H_5,\ C_2H_5,\ C_2H_5\}$$

Further, the constitution of phosphoric acid will be

$$P\{OOH,\ OH,\ OH\}$$

showing it to be the mono-oxy-acid of phosphorous acid, and the existence of di- and tri-oxy-acids consequently may be predicted. The author believes to have already obtained the compound

$$P\{O\cdot OH,\ O\cdot OH,\ O\cdot OH\}$$

(*Zeitschr. Chem.* N. F. iii. 321.)

Neurin.—A. Baeyer. The constitution of neurin is that of the hydrate of trimethyle-oxcthyle-ammonium

$$=N(CH_3)_3\left\{\begin{matrix}(C_2H_4(HO)\\H\end{matrix}\right\}O$$

*This is identical with the process by which I prepared considerable quanties of thallium four years ago. For full details see Chemical News, vol. viii., p. 159.—W.C.

The auro-chloride of this base

$$=NC_5H_{14}OCl,AuCl_3$$

is soluble in hot water, and crystallises in beautiful yellow needles. The hydriodate of neurin has the formula

$$N(CH_3)_3(C_2H_4(OH))I.$$

but if neurin is heated with an excess of hydriodic acid, water is eliminated, and the iodide $N(CH_3)_3(C_2H_4I)I$ formed which on being treated with argentic oxide yields a base, the auro-chloride of which has the composition $NC_5H_{12}Cl,AuCl_3$, showing thus a conversion of neurin into a vinyle-compound. The platino-chloride contains one molecule of water. In order to remove any doubt as to the existence of oxethyle $=C_2H_4(OH)$ in neurin, the action of acetylic chloride upon the latter had been tried, and a body obtained of the composition

$$N(CH_3)_3(C_2H_4)(O,C_2H_3O)\left.\begin{matrix}\\ H\end{matrix}\right\}O$$

which is neurin wherein an atom of hydrogen is replaced by acetyle.—(*Ann. Chem. Pharm.* cxlii. 322).

NOTICES OF BOOKS.

Gas Manipulation. By the late Henry Bannister, Enlarged by Wm. T. Sugg. London: Henry Sugg, 32, Henrietta Street, Covent Garden. 1867.

Our most eminent chemical authorities have lately interested themselves so deeply, not only in the actual quality of coal-gas, but also in practical details whose consideration is necessary for understanding how impurities appear, persist and accumulate, that, as a result, gas manipulation has become a branch of study that may be called chemical jurisprudence. Thus, within a very few years, by laborious investigations of chemists, the subject of gas supply, with the impurities of gas, has been raised to a degree of accuracy equal or even superior to that of the sister subject of water supply, with its impurities. These two subjects, with histories so very different, have reached a nearly identical climax, in that the chemist and the engineer will for the future have nearly an equal weight of evidence to give in the witness box, on questions touching either subject. A branch of the science is thus steadily growing in importance, and we should welcome with much pleasure a short text-book on this department of chemical jurisprudence for the busy practical man.

Such a work would now, thanks to the enterprise of publishers, and the increasing number of text-books on all these subjects, be a mere matter of compilation, giving in one volume information of the most valuable character, now scattered in scores, or even hundreds of books and pamphlets, which matter, we have much reason to fear, will be quite lost to the profession if not properly secured in time.

In the absence of such a book, however, Bannister's, or rather Sugg's gas manipulation (so greatly has the original book been enlarged and improved), will for many years be a valuable text-book for the chemical jurist; this could not so justly be stated of the former edition.

With regard to some minor points, in fairness to our readers we must make a few remarks and extracts;—thus the use of turmeric paper for testing the presence of volatile alkali, is advocated without any mention of the fallacies that attend its use; the very great superiority of red litmus paper in this respect has generally been insisted upon, especially by Mr. Bowditch. Again, for the quantitative estimation of ammonia, the decimally divided imperial liquid measure is used, which, however good in its way, has not the sanction of extensive use by chemists. With an English and French method in vogue of nearly equally extensive use, there is no room even for "a golden mean" system, as its advocates would call it. In any estimates made in legal statements, a very simple question would become infinitely involved by the necessary explanation that one cubic inch = 36·06543 septems, and that 1 litre = 2·2 decigallons. We think that by quoting one example, the volumetric testing by this method will be seen to be decidedly inferior to more recent methods.

"For testing ammonia by oxalic acid"—"the following solutions are required." 1. A solution of oxalic acid, 100 septems of which are equal to 10 grains of ammonia; 2. A solution of ammonia of which 100 septems contain 1 grain of ammonia. 3. Tincture of hematine; for this septem-burettes, &c., are used; the results thus obtained are not at all readily calculated either into grain or gramme measures.

In another part of the book, fluid ounces and drachms are used for volumetric purposes.

A valuable portion of the work is devoted to the question of photometry, which is most skilfully handled. Two full-paged illustrations of the photometers of Bunsen and Dr. Letheby respectively are given in white lines on a black ground, and the doctrine of irradiation as connected with luminous impressions, is very markedly illustrated on a large scale by these beautifully clear prints. 15 other engravings are also given on toned paper, equally artistically executed; and we have no hesitation in saying that this is the most perfectly illustrated scientific work that we know of, published in England.

We leave to our readers the pleasure of reading the details of the self-registering photometer, by which with the aid of photometry the varying pressure of gas may be registered during the 24 hours,

It has been named after the workers out of the idea, Messrs. Kirkham and Sugg, who acknowledge the valuable assistance rendered by Mr. Glaisher.

To those of our readers who have studied Mr. Bowditch's experiments on the value of illuminating candles, which seemed of such a convincing nature, and have remembered Dr. Frankland's remarks on the same subject, the following extract from the preface will be of interest;

"The variations so frequently found to occur when using the standard candle in conducting experiments, are shown to be in a great measure attributable to a defective mode of application; and suggestions, based on actual practice, are offered, the adoption of which will ensure as great an approximation to the truest results as the present Parliamentary regulations will admit of."

CORRESPONDENCE.

PRESERVATION OF FOOD.

To the Editor of the Chemical News.

Sir,—In reference to our pamphlet upon the preservation of food, will you permit us to state that with the mass of evidence at our disposal we could readily have shown a long list of the so-called "preservative processes" which have proved utter failures, and could have conclusively exhibited the causes of their non-success, but such a course would have necessitated the mention of numbers, dates, and names, together with comparisons which might possibly have been considered invidious, and we preferred, while giving the public much general information relating to what has hitherto been attempted in meat preservation, to keep out of the treatise anything likely to be considered personal, or to give offence.

We beg to draw your attention to the sixth edition of the pamphlet, containing much new matter, and to remark that the practical success of Medlock and Bailey's new patent process, as evidenced by the results obtained by various well-known metropolitan butchers, meat-salesmen, fishmongers, &c., has been quite beyond our expectation for the short period that has elapsed. The Canadian experiments were conducted by Mr. Collett, and those in this country, under the superintendence of Dr. Henry Medlock and Mr. Wentworth Scott.—We are, &c.,

William Bailey and Son.

REMARKS ON THE EARTH'S DENSITY.

To the Editor of the Chemical News.

Sir,—My attention has again been directed to the difference existing between the earth's density and the mean specific gravity of the minerals constituting its crust, by the following paragraph, occurring in a recent lecture by Mr. T. Sterry Hunt:—"We may suppose an arrangement of the condensed matters at the centre (of the earth) according to their respective specific gravities, and thus the fact that the density of the earth as a whole is about twice the mean density of the matters which form its solid surface."

On the same subject, W. R. Grove, Esq., in his address to the British Association, 1866, makes the following remarks:—"Surprise has often been expressed that while the mean specific gravity of the globe is from five to six times that of water, the mean specific gravity of the crust is barely half as great. It has long seemed to me that there is no ground for wonder here. The exterior of our planet is to a considerable depth oxidated; the interior is in all probability free from oxygen, and whatever bodies exist there, are in a reduced or deoxidated state; if so, their specific gravity must be higher (?) than that of their oxides, chlorides, &c."

This theory of Mr. Grove, although plausible, is scarcely satisfactory, as it will be seen that many of the substances which go to form the great bulk of the earth's crust, are actually lower in specific gravity as metals than they are when oxidised; while others differ but little in density whether as metals or oxides. The metals whose densities are much lower than their oxides are the metals which form but a small proportion of the earth's crust, and the oxidation or deoxidation of which could make but a trifling difference in our earth's density. Any such difference would be more than counteracted by the opposite tendency of those substances which constitute the great bulk of the earth's crust, as shown in the following table:—

Metals	Sp. gr.	Oxides.	Sp. gr.
Silicon	2·49	Silica	2·66
Calcium ..	1·57	Lime	3·08
Magnesium ..	1·74	Magnesia ..	3·40
Aluminium ..	2·56	Alumina* ..	4·00
Sodium	0·97	Soda	2·00
Barium	1·50	Baryta	4·00
Potassium ..	0·86	Potassa	2·10
Strontium ..	2·50	Strontia	3·90

These examples prove that supposing the earth, beneath the crust to which we have access, to consist of the same metals as above, but in an unoxidised state, the density of the earth would actually be less than the specific gravity indicated by an average of the minerals existing on the surface. Unless, indeed, a far greater proportion of the heavier metals exist in the interior of the earth than on its surface. That the heavy metals do exist in much greater proportion towards the centre of the earth I think is undoubtedly the case, and the only means of solving the difficulty.

During the cooling down of the molten planet the heaviest metals would naturally tend towards the centre, and hence if we take a table of specific gravities of the metals, we find a singular relationship to exist between the *density* and *scarcity* of a metal.

Thus we find platinum and gold to stand almost at the head of the list in point of density and scarcity, while aluminium, calcium, magnesium, &c, stand conspicuous for their great abundance and for the lowness of their specific gravities. The metals mercury, zinc, lead, &c, may appear at first sight not to fit in with this supposed law, but when we take into account either their ready volatility or their avidity for sulphur or oxygen, as the case may be, their comparative abundance at the earth's surface may be explained notwithstanding their high densities. For instance, mercury and zinc would be among the very last of the solid substances, volatilized by the earth's heat, to condense; and would in all probability come into contact with large quantities of sulphur vapour, and would naturally take that form in which we find these metals most abundantly.

Another exceptional circumstance may be instanced as operating against the tendency of the metals to follow this law of specific gravities, in the case of iron and tin. Iron has a sp. gr. of 7·8 while tin is only 7·2. The apparent sequence to this, according to the foregoing argument, would be that tin should be more plentiful than iron. We must here again, however, take into account the contingent circumstance that iron is much more readily oxidized than tin, and when once brought into that state has the low sp. gr. of 4 to 5. This will account for the fact that iron, nothwithstanding its higher sp. gr. than tin, is much more abundant at the earth's surface than tin. These I give only as examples of the exceptional circumstances that require to be considered in framing the general proposition that *the scarcity of a metal is in the ratio of its density.*

These consideration seem to me to point distinctly to the presence of the heavier metals in much greater abundance in the interior of the earth than at its surface, and especially when taken in conjunction with the fact that the earth has a density twice as great as the minerals of which its crust is composed, and that notwithstanding the probability that it contains many great cavities filled with water or gases.—I am, &c.,

John Sutherland.

Glasgow.

* After being heated strongly.

GAS ABSORBED BY CHARCOAL.

To the Editor of the Chemical News.

Sir,—Your correspondent from New Zealand, Mr. William Skey, asks me, in No. 400 of the Chemical News, whether Drs. Blumtritt and Reichardt have proved—as he has—that *incandescent* charcoal absorbs nitrogen from the air?

They certainly have done so; their researches extend to a great many varieties of charcoal, both old and freshly ignited, and contain many full analyses of gas. The date of the first notice about them in the *Chemische Centralblatt* is September 12, 1866, and the paper is a reprint from the *Zeitschrift für deutsche Landwirthe.* The original publication must, therefore, be somewhat older, especially as the *Centralblatt* is generally several months behind; but at all events their priority of publication to Mr. Skey's communication cannot be doubted. However, it would be exceedingly unfair to say that this gentleman, living at such a distance from Europe, *could* in all probability have come across a German periodical, which would hardly have time to reach him in the interval between the publications; I expressly remarked in my letter in No. 372, that, "their paper has most likely not yet been noticed in English chemical periodicals." No one can have the slightest doubt that Mr. Skey has independently rediscovered the property of charcoal in question, although his opportunities in New Zealand could hardly allow him to extend his researches so systematically as those of the European *savants.*—I am, &c.,

G. L.

August 3, 1867.

MAGNETISM AND GRAVITATION.

To the Editor of the Chemical News.

Sir,—I should not trouble you with a second letter on the above subject had not Mr. Newlands in his reply to my former note misquoted one of my sentences, and thereby entirely altered its meaning. The sentence should stand thus: "If the distance between the pole of a magnet, and a magnetic body be very considerable,

compared to the size of the latter, both the induced poles may be regarded as at the same distance," &c., &c.

A careful reconsideration of this sentence may perhaps convince Mr. Newlands, that it is in perfect harmony with all examples advanced by him, and may show him, that he is confounding the merely (or at least almost exclusively) directive action of one magnet, or pole, on another magnet at a great distance, with the attraction or repulsion exerted between two opposite poles. Thus, a small magnetized needle, when floated on water, places itself in the direction of the magnetic meridian; but why, if it does so by virtue of the superior attraction of the North pole, does it not also move in the direction of such pole? Does not the very fact of its remaining at rest in the direction of the meridian prove that the two forces of attraction and repulsion are sensibly equal? I would, in conclusion, recommend Mr. Newlands to make the following calculation: What is the difference between the forces of attraction and repulsion exerted on the poles of a magnetic needle 1 inch long by a magnetic pole several thousand miles distant, the needle pointing towards such pole? If, after having performed this calculation, according to the well-known law that the force of attraction or repulsion varies inversely as the square of the distance, he still believes that such difference may be a measurable amount, why—I hope that he will soon furnish the world with a description of the instrument by means of which he thinks to accomplish it.—I am, &c.,

A. D.

MISCELLANEOUS.

A New Science Scholarship.—On Friday, 26th ult., was celebrated the 30th anniversary of the City of London School, and upon that occasion a report was presented detailing the progress made towards the foundation of a *Testimonial Scholarship* in honour of the Rev. G. W. F. Mortimer, D.D., late head master, whose eminent services in the cause of education, and especially in the successful conduct of the school for a period of more than a quarter of a century, were deemed worthy of public and permanent recognition. For the purpose of giving effect to this resolution a committee, composed of old pupils of the school, and a few leading members of the Corporation, took the matter in hand shortly after Dr. Mortimer's retirement, and invited subscriptions, which already amount to about five hundred pounds. This sum will, it is believed, be further augmented, so that an annual grant of at least twenty pounds may be realised. It has now been proposed by Mr. Ernest Hart, one of the secretaries, to devote the proceeds to the encouragment of the study of science in the school, and, by granting an annual premium, assist in supporting a pupil either at the Royal College of Chemistry, or other scientific educational establishment of Great Britain. This proposal met with the hearty approval of the subscribers, and its expediency was strongly urged by Mr. Thomas Hall, B.A., who for twenty years past has conducted the science classes in the City of London School. When this suggestion has been finally decided upon we will inform our readers; in the meanwhile, it should be mentioned that there is already a medical scholarship (tenable for three years at St. Thomas's Hospital), and that Mr. Alderman Hale presents a silver medal for proficiency in chemical science, to be competed for annually by the pupils, all of whom, to the number of six hundred, are now taught chemistry as a branch of general education in the school. We notice the names of Mr. W. H. Perkin and Mr. J. Spiller among those acting on the committee, and in the list of subscribers to the Testimonial Fund are to be seen the names of several other chemists who received their early scientific training in the school. The treasurer, J. Sharp, Esq., LL.D., was also formerly one of Dr. Mortimer's pupils.

Composition and Quality of the Metropolitan Waters in July, 1867.—The following are the Returns of the Metropolitan Association of Medical Officers of Health:—

Names of Water Companies.	Total solid matter per gallon.	Loss by Ignition.*	Oxydisable organic matter.†	Hardness.	
				Before boiling.	After boiling.
Thames Water Companies.	Grains.	Grns.	Grain s	Degs.	Degs.
Grand Junction	18·67	0·75	0·82	12·5	4·0
West Middlesex	17·44	0·60	0·71	12·5	3·5
Southwark and Vauxhall	18·16	0·42	0·71	12·5	4·0
Chelsea	17·80	0·59	0·71	13·0	4·0
Lambeth	17·51	0·72	0·80	12·5	3·5
Other Companies.					
Kent	28·49	0·50	0·42	15·5	7·5
New River	17·00	0·49	0·39	12·5	5·0
East London	17·83	0·49	0·46	12·5	5.0

* The loss by ignition represents a variety of volatile matters, as well as organic matters, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

† The oxydisable organic matter is determined by a standard solution of permanganate of potash—the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

The amount of ammonia in the water and of that derivable from organic nitrogen did not in any case exceed the 0·0094 of a grain per gallon of water, and there was no organic nitrogen or ammonia in the Kent water. It was, therefore, absolutely free from organic matter of an animal origin. H. Letheby, M.B.

The State of the Thames.—In a letter to the *Times* dated August 7th, "Y" writes, that last night during low water tne characteristic stench of the Thames was distinctly perceived by several independent observers on the terrace at the Houses of Parliament, though in a less degree than in former times. As the water of the river is chemically examined from time to time by persons appointed by the Board of Health, it would be interesting to learn from them whether either the proportion or condition of the organic matter in the water will explain the unwelcome fact.

Economy of Light in Dark Alleys.— If in a very narrow street or lane, we look out of a window with the eye in the same plane as the outer face of the wall in which the window is placed, we shall see the whole of the sky by which the apartment can be illuminated. If we now withdraw the eye inwards, we shall gradually lose sight of the sky till it wholly disappears, which may take place when the eye is only *six* or *eight* inches from its first position. In such a case the apartment is illuminated only by the light reflected from the opposite wall, or the sides of the stones which form the window; because, if the glass of the window is *six* or *eight* inches within the wall, as it generally is, not a ray of light can fall upon it. If we now remove our window and substitute another in which all the panes of glass are roughly ground on the outside, and flush with the outer wall, the light from the whole of the visible sky and from the remotest parts of the opposite wall, will be introduced into the apartment, reflected from the innumerable faces or facets which the rough grinding of the glass has produced. The whole window will appear as if the sky were beyond it, and from every point of this luminous surface light will radiate into all parts of the room. In order to explain the superior effect of roughly ground glass, let us suppose that the ordinary window is replaced with a single sheet of the best glass inserted flush with the outer wall. The whole of the light from the visible portions of the sky will fall upon its surface, but at such an obliquity that four or five-sixths of it will be reflected outwards, and the other two or one-sixth, which is transmitted, will fall on the floor or on the shutters, and be of no value.—*Sir D. Brewster.*

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Journal fur Praktische Chemie. April 4.

C. Heintzel "On Triamidophenol and Amidodiimidophenol." K. Frish "Researches on Creosote." A. W. Hofmann "On the Transformation of the Aromatic Monamines into Acids containing a larger Proportion of Carbon." F. Rochleder "On the Constituents of the Root Bark of the Apple Tree." "On the Elementary Analysis of Organic Substances." K. Frisch "On a Method of testing Fused Soda." Schrotter "On some Nickeliferous Cobalt Ore from Dobschau." Hlasiwetz and Grabowski "On Carminic Acid." Hlasiwetz "On Caffeic Acid." F. Rochleder "On the Action of Nascent Hydrogen on Chinine, Cinchonine, and Caffeine."

April 15, 1867.

W. Michaelis "On Portland Cement." Peterson "Analysis of Apatite from Diez, in Nassau." A. Baeyer "On the Constitution of Mellitic Acid."

Le Technologiste. May 1867.

W. Naylor "On Smoke-consuming Furnaces." W. De La Rue and H. Muller "On the Extraction of Copper and Silver from Iron Pyrites." G. Lunge "On the Manufacture of Nitrate of Potash and of pure Carbonate of Potash." C. Dietrich "On the Preparation of Chrome Green."

Journal des Fabricants de Papier. March 15, 1867.

E. Bourdilliat "On Testing the Chemical Products used in Paper Making." E. A. Cotelles "Apparatus for utilising Chlorine Residues." Taquet "A Method of Removing Boiler Scale by Means of Potash." J. M. Mellor "A Method of softening, separating, and bleaching Vegetable Fibres."

April 1.

E. Bourdilliat "On testing the Chemical Products used in Paper-making." A. Ott "On the use of Petroleum for lubricating Machinery." Crane "A new Safety Paper for preventing Bank Note Forgeries."

April 15.

E. Bourdilliat "On testing the Chemical Products used in Paper-making." H. Berge "On Lignite from Moldavia."

May 1.

E. Bourdilliat "On testing the Chemical Products used in Paper-making." "On the Estimation of Wood Pulp in its dry State."

Genie Industriel. May, 1867.

P. Du Rieux and Roettger "An Improved Cylindrical Filter Press." Bloch "A Method of joining Lead and other Metal Tubes." C. Stammer "On the comparative Advantages of Washing Sugar Filters with Hot and Cold Water." T. Gray "On the Preparation and Treatment of Flax and Hemp." Marechal and T. Du Motay "On Bleaching Animal and Vegetable Fibres." "On the Use of Kamptulicon as Armour Plating." Guenier-Lauriac "A Method of Casting Rolls, Columns, and Guns with an external Skin of Hard Iron." Leveque "Apparatus for charging and collecting Gases from Blast Furnaces." Schlotterbek "Varnish for protecting the Surface of Iron from Rust."

Sitzungsberichte der Wiener Akademie (Mathematical and Physical Section. December, 1866.

W. F. Gintl "A new Pinch Cock for stopping India Rubber Tubes." F. Rochleder "On the Elementary Analysis of Organic Substances." K. Fritch "On the periodical Phenomena of Plants." "On the ripening of Seeds and Fruits in Australia." A. Brio "On the Crystalline Form of Fomiate of Baryta."

Comptes Rendus. No. 19.

Becquerel "Memoir on some newly-discovered Chemical Effects of Capillary Action." Boussingault "On the Effect of Mercury Vapours on Flowers." C. Deville "On the Periodical Variations of Temperature." Civiale "Description of a Collection of Urinary Calculi, classified according to their Structure and Development." C. Briot "On Crystalline Reflection and Refraction." Potier "Researches on the Diffraction of Polarised Light." H. Marie-Davy "On the 'Electric Mass' of Conductors." P. P. Deherain "Experimental Researches on the Use of Potash Salts in Agriculture." J. J. Chydenius "On Pseudo-Hexyl-Urea." E. Grimaux "On the Brominated Derivatives of Gallic Acid."

Annalen der Chemie und Pharmacie. April 1867.

C. D. Braun "On the Formation of Certain Cobalt Amine Compounds." C. Engler "On the Action of Bromine on some Nitriles." "On the Action of Ammonia on Trichlorhydrine." R. Otto and O. Von Gruber "On Toluol-sulphurous Acid. R. Otto "A simple Method of preparing Crystallised Sesquioxide of Chromium." C. Weltzien "On the Hydrated Suboxide and Oxide of Silver." "On the Formation of Ozone." A. Siersch "On the Preparation of the Fatty Alcohols from their Primary Members."

May.

L. Carius, "On the Synthesis of Organic Acids." E. Schulz and A. Reinecke, "On the Analysis of Animal Fats, especially those of Mutton, Beef, and Pork." H. Hlasiwetz, "On some Tannic Acids." H. Hlasiwetz, "On the Brominated Derivatives of Gallic Acid, and Oxyphenic Acid." Guckelberger, "On the Extraction of Thallium."

NOTES AND QUERIES.

Stearic Acid in Paraffin.—Sir,—In reply to your correspondent "X'a" query in last week's Chemical News, I can recommend him to try Wagner's test. Dissolve the suspected paraffin in boiling alcohol, and add to it an alcoholic solution of acetate of lead. If stearic acid be present a white precipitate will fall of stearate of lead, but if the paraffin be pure no precipitation will take place. I can speak from experience as to the value of this process.—B. Hoffman.

Wires for Micrometers.—Sir,—I think perhaps the best thing your correspondent, "O. Ramsbottom," can use for the above purpose is asbestos. This was suggested many years ago by Professor Wallace, who states that fibres of this substance of the 1-3000th of an inch in diameter give a line beautifully even under the microscope and of considerable opacity; the subdivision of the substance can be carried to almost any degree of minuteness.—J. S. S.

Nitrogen, Preparation of.—Sir,—"Theta" will probably find the following plan answer his purpose:—Half fill a tubulated retort with dry nitrate of ammonia. By means of a wire passing stiffly through a cork in the tubulus suspend a piece of zinc so that it can be moved up and down at will. Fuse the nitrate of ammonia by heat, and then push the zinc down into it. Nitrogen and ammonia will be evolved, and the latter can be absorbed by collecting over water or by passing through Woulff's bottles containing water and dilute acid. By adjusting the height of the zinc and the temperature of the salt the disengagement of gas may be varied as desired.—S. Peterson.

Picric Acid.—Sir,—Out of the many works on chemistry that I have, besides the last seven volumes of the Chemical News, I have not in them all a good process for making picric acid. All the processes that one reads are thus:—Picric acid is formed by acting on carbolic acid with nitric acid, assisted by a little heat. Now, what I want to know is, the proportions of carbolic acid and nitric acid, and the strength of the nitric acid, and the degree of heat, and the length of heat, and the length of time that it has to be heated; or, in other words, a good process for making it. If you can give me the above information through the News, I shall feel extremely obliged.—S. R.

Nitrogen, Preparation of.—A correspondent informs us, in answer to the query on this subject, that the best way to prepare nitrogen is to react on dilute ammonia with bromine. The ammonia is to be put into a tubulated retort, or Woulff's bottle, and the bromine poured in through a funnel-tube reaching to the bottom. Nitrogen comes off freely, and may be collected over water. No bromide of nitrogen is formed. The product is bromide of ammonium.

Oxalate of Cerium—Silicide of Aluminium.—Sir,—Could any of your correspondents inform me what remains on igniting the oxalate of cerium, and how to obtain silicide of aluminium?—C. R. N. P.

A Specific Gravity Problem.—Sir,—Might I, through your valuable column of Notes and Queries, ask assistance in the following case:—In examining some meteoric iron I found its sp. gr. (using 50 grains) to be 6·1, but as this iron was intimately mixed with olivine, I afterwards dissolved out the iron in acid, and found that 20 grs. olivine were left behind, which had the specific gravity of 3·2. Now, how can I calculate the true specific gravity of the 30 grains iron actually present? I have no doubt that some of your correspondents can help me in this dilemma. σιδερος.

ANSWERS TO CORRESPONDENTS.

Table of Contents.—In deference to the strongly-expressed wishes of many correspondents, it has been decided to resume the weekly table of contents on the front page of the Chemical News.

Paris Exhibition.—Our correspondent's weekly article did not arrive till too late for insertion in this number.

Effra.—Tannate of alumina may be prepared by grinding together in a mortar equal equivalents of freshly precipitated alumina and tannic acid. Wash and dry spontaneously.

Filhol.—A letter will be sent by post. The subject is one unsuitable for this column.

B. Y. G.—The best thing to remove grease stains from silk is ether. If you use methylated the expense will be trifling.

E. J.—The patent was taken out on March 2, 1862. See the Chemical News for July 26, 1862, p. 55.

A Bee.—Permanganic acid is volatile, and may be distilled with caution, but the operation is not unattended with danger, as it sometimes explodes.

A Reader from the first.—The crystals have been examined and prove to be acetate of morphia. The quantity you name is a highly dangerous dose.

C. Porter.—The best enamel to use is boro-silicate of soda. This is not attacked by vinegar, salt, or other ingredients used in cooking. The silicate of lead which is sometimes used as an enamel, gives up its lead to many liquids. It should, therefore, be carefully avoided in manufacturing utensils for the kitchen.

Artist.—Constant white is the trade name for sulphate of baryta.

Communications have been received from Townsend and Adams, New York; Dr. E. Rohrig (with enclosure); C. R. A. Wright, B.Sc.; Radcliffe and Layton (with enclosure); F. Maxwell Lyte; A. Bird; Dr. Lunge; J. C. Bell; Dr. E. A. Cook; F. Vikars; J. Dodd (with enclosure); M. Farquarson; S. E. Wood (with enclosure); L. Hughes; Dr. Anderson (with enclosure); J. Taylor; G. A. Keyworth; E. Scott; W. Bailey; S. Robertson (with enclosure); Professor Church, M.A.; C. Tomlinson, F.R.S.; Harold Thompson; A. Jones; E. Maxwell, United States.

THE CHEMICAL NEWS.

Vol. XVI., No. 402.

ON THE ACTION OF CHLORINE ON CARBONATE OF SILVER. PREPARATION OF CHLORATE OF SILVER.

By Professor J. S. STAS.

If oxide or carbonate of silver suspended in water is diffused through an excess of saturated chlorine water, the silver is completely changed into chloride, as in the case of oxide and carbonate of mercury; and the water only contains besides the excess of chlorine pure hypochlorous acid, without a trace of chloric or perchloric acid. The chlorometric standard of the liquid, after the chlorine has acted on the carbonate, is almost identical with that of the chlorine water employed.

By passing a slow current of chlorine, *with constant agitation*, into water containing an excess of carbonate of silver in suspension, the first action is identical; there are still produced chloride of silver and hypochlorous acid, but this hypochlorous acid only remains momentarily free, it slowly transforms another part of the carbonate into metallic hypochlorite. Indeed, if at the end of a short time the current of chlorine is interrupted, the agitation being continued all the time, the liquid loses the characteristic odour of hypochlorous acid, but preserves its energetic decolorising power, because the hypochlorite of silver which is formed is very soluble in water.

Hypochlorite of silver, which to my knowledge has never before been described, is sufficiently stable in the presence of an excess of carbonate of silver, to remain undecomposed for several days; it is, on the contrary, very instable in the absence of this metallic oxide or carbonate. It has, indeed, appeared to me that so long as the solution of hypochlorite of silver is kept agitated with the carbonate the liquid preserves its transparency and decolorising power; if, on the contrary, it is left at rest, scarcely has the carbonate of silver settled when the limpid liquid becomes opalescent, and soon deposits large flakes of chloride of silver, which cover with a white coating the carbonate of silver at first deposited. The liquid at the same time loses its decolorising power, and only contains chlorate of silver in solution, rendered alkaline by a small excess of carbonate dissolved.

According to what I have here shown, it is evident that the formation of chlorate of silver by the action of chlorine on the carbonate, is the result of a secondary reaction of the hypochlorite of that metal which is previously formed, It would appear, moreover, as if all other chlorates were formed in a similar manner, but this is not the place to enter into this question.

The successive reactions may be represented by the following equations:—

$$12Cl+3Ag_2O+3H_2O=6AgCl+6HClO$$
$$6HClO+3Ag_2O=3H_2O+6AgClO$$
$$6AgClO=4AgCl+2AgClO_3$$

I may say that argentic hypochlorite is very soluble in water; indeed, the clear liquid containing carbonate of silver suspended in it, and through which a slow current of chlorine has been passing for some hours, contains a considerable quantity of hypochlorite, which remains intact so long as it is in contact with the carbonate; but the excess of carbonate employed fixes on itself a large quantity of this hypochlorite, or, at all events, of the elements of this salt. The fixation of hypochlorite on this very slightly soluble argentic compound, results from two facts observed during the four times I have produced chlorate of silver by the action of chlorine on the carbonate and oxide. The first is the impossibility of washing these bodies after chlorine has acted on them for a certain time. Whatever care is taken, and however the washing is effected, the water always contains, besides the carbonate, a salt of silver containing chlorine and oxygen; the second fact is, that the carbonate on which chlorine has acted for a sufficient time to produce hypochlorite in solution, will still, after washing, furnish, under the influence of chlorine, a fresh quantity of hypochlorite, much more considerable than that which could result from the chlorine used in this second reaction. Observation has even proved that the greatest production of soluble hypochlorite takes place when two-thirds of the carbonate have been already submitted to the decomposing action of the chlorine.

Hypochlorite of silver is the sole silver salt that is formed by the action of chlorine on *an excess* of oxide or carbonate of silver suspended in the liquid and kept in a state of continual agitation. Spontaneous decomposition, or decomposition effected by the aid of heat, never produces the least trace of perchlorate when I have operated on a hypochlorite rendered slightly alkaline by an excess of carbonate in solution. During the passage of the chlorine, the hypochlorite which is formed may be destroyed again with formation of chloride of silver; but hypochlorous acid is still formed under these circumstances, and by reacting on a fresh quantity of carbonate of silver, a double quantity of hypochlorite is reproduced.

The conditions necessary to form chlorate of silver, according to the above observations are therefore these:—A *slow* current of chlorine must react on the carbonate of silver (previously treated with chlorine to remove the alkali which it may contain) suspended in water and kept constantly in agitation until the chlorine has attacked the greater portion of the argentic compound employed; this agitation must be continued after the interruption of the current of chlorine, so as to change the free hypochlorous acid existing in the liquid into hypochlorite; the solution of argentic hypochlorite must be separated from the excess of the argentic compound employed in the first instance, so that the hypochlorite may change spontaneously into chloride and chlorate. The following is a description of the arrangement I adopted, so as to satisfy, as far as possible, the above conditions:—

Three kilogrammes and 935 grammes of nitrate of silver, free from foreign metals, were dissolved in twenty litres of distilled water; the solution was poured, in small quantities at a time, into an equal volume of solution of carbonate of potassium prepared from pure cream of tartar. The carbonate of silver, which was voluminous, and of a very pale yellowish white, after having been kept for a long time suspended in an excess of solution of carbonate of potassium, was washed by decantation in the cold until no more potassium could be detected in the residue left by the washing water after evaporation to dryness. To arrive at this point I was obliged each time to violently shake up the carbonate of silver with water in a closed flask, as is done in a silver assay, to clarify the liquid. Taking these precautions, the washings lasted for fifteen days, repeating them several times a day.

The thin paste of carbonate of silver (which from its original yellowish white, had become of a beautiful yellow colour) was introduced into a flask of 45 litres capacity, covered with black cloth. This flask was fixed firmly in a frame attached to a kind of stirrup suspended above the ground by long cords. At each side, and at the foot of this stirrup, a string was fixed, and by alternately exerting a tractive movement by these strings, as strong an oscillatory movement as is desired could be communicated to the flask. To the neck of the flask was affixed a glass stopper pierced with two holes, one of which allowed the passage of a glass tube bent at right angles and leading the chlorine into the liquid, and the other admitted a glass tube, likewise bent, which allowed the escape of the carbonic anhydride set at liberty by the decomposition of the carbonate of silver. The tube by which chlorine was pas-

sed into the liquid was connected with a chlorine generating apparatus, by means of a vulcanised caoutchouc tube, long enough to permit free oscillation of the apparatus without exerting traction on the chlorine apparatus. The vulcanised caoutchouc tube had been boiled for an hour with a ten per cent solution of hydrate of sodium to desulphurise it, and was then washed with pure water.

The apparatus being so arranged I allowed a *very slow* current of chlorine* to pass into the flask for an hour and a quarter, keeping it during the whole of this time in continuous movement. I then stopped the current of chlorine and continued to agitate the liquid so long as it exhaled the least odour of hypochlorous acid. The apparatus was then left at rest and the strongly coloured supernatant liquid was decanted. The carbonate of silver was then washed again by decantation, the first liquid decanted being added to the solution of hypochlorite already separated. The carbonate of silver was washed as long as it was possible to to ascertain by aid of the spectroscope any traces of potassium in the residue left after evaporating the washing waters to dryness.

The solution of hypochlorite of silver, after having been preserved in darkness until it ceased to deposit chloride of silver, was evaporated to dryness; it left 31·819 grammes of a white saline residue.

The washed carbonate of silver, in the form of thin paste, was now introduced, with four litres of water, into the flask, and exposed for two hours to a current of chlorine, the agitation being incessant the whole time, and being kept up after the current of chlorine was stopped so long as the mixture smelt of hypochlorous acid. It furnished by decantation five litres of a strongly decolorising solution, which, left in darkness to spontaneous decomposition, yielded on evaporation 58·237 grammes of chlorate of silver.

The carbonate of silver was now washed for a third time. Already in the first washing water it was impossible for me to discover the least trace of potassium, by the aid of spectrum analysis, on examining the residue left by a whole litre of liquid.

I then diffused the carbonate of silver in a volume of water equal to that of the liquid decanted off, and for three hours exposed it to an uninterrupted current of chlorine with continual agitation. After the current of chlorine was stopped the mixture was kept in agitation for half-an-hour; after decantation the clear and colourless liquid did not emit the least odour of hypochlorous acid, but it had strong bleaching properties. On standing it deposited large quantities of chloride of silver, and on evaporation yielded 72 grammes of chlorate of silver.

Finally, the carbonate of silver, mixed with a considerable quantity of chloride of silver, was washed for a fourth time. Diffused through six litres of pure water it was exposed for six hours in the vibrating flask to a continuous current of chlorine. The hypochlorous acid having been changed into hypochlorite of silver by agitating the liquid with the remaining excess of carbonate of silver, I left the liquid to repose till all the hypochlorite was changed into chlorate and chloride. On evaporating the clear liquid with the usual precautions, I obtained in this operation 23 grammes of chlorate of silver.

I ceased acting with chlorine on the carbonate of silver because the salt was so whitened by admixture with chloride of silver that it was impossible by sight alone to distinguish whether any were present or not. Besides, when I stopped the operation the evaporation of all the liquids was not finished sufficiently for me to know how much chlorate was formed. On the supposition that the chlorine had acted to its fullest extent, I ought to have obtained 700 grammes of chlorate, but the total weight of the salt left on evaporating the four decanted liquids only came to 285 grammes. I had only produced two-fifths of the theoretical quantity, and it was therefore impossible to have obtained any perchlorate of silver.

The chlorates obtained in these operations were submitted to the following treatment:—

A portion of the 31·819 grammes obtained in the first operation having been examined in the spectroscope, was found to contain much chlorate of potassium. I did not therefore purify it.

The 58·237 grammes of chlorate from the second operation were dissolved in cold water. The solution was found to be faintly alkaline. Dilute chlorine water was added to it so as to cause the alkaline reaction to disappear, and it was then boiled in order to precipitate the traces of chloride of silver thereby produced. The perfectly neutral liquid was decanted and evaporated. Three separate crops of crystals were obtained from it. Each of these was separately reduced to the state of chloride by means of sulphurous anhydride.

A current of sulphurous anhydride precipitates sulphite of silver from a solution of chlorate, and the liquid contains chloric acid. This sulphite of silver only passes to the state of chloride by the consecutive action of sulphurous anhydride on chloric acid. During the passage of the gas there is, however, no way of telling whether the reduction of the chloric acid is partial or total, whether there is too little or an excess of sulphurous acid, and the amount of the excess. Another difficulty is occasioned by the relative slowness with which sulphurous acid reduces at 0°C. very dilute chloric acid; and, notwithstanding this, a low temperature and a great dilution of the liquid are indispensable conditions of success. I have, therefore, effected the reductions of chlorate of silver by means of a standard solution of sulphurous acid.

I now return to the three portions of chlorate of silver obtained from the 58·237 grammes of the second operation. The first portion containing the least soluble salts, still contained potassium, as shown by spectrum analysis. The second portion I lost in an attempt to reduce it in a current of sulphurous anhydride gas; the third part, weighing 23·932 grammes, was reduced by a standard solution of sulphurous acid at 0°C.

The 72 grammes of chlorate of silver produced in the third operation were dissolved in cold water. The solution was opalescent, and appreciably alkaline. I added carefully, dilute chlorine water till the alkaline reaction disappeared, then heated to precipitate the chloride of silver formed, and evaporated the decanted liquid over a water bath till a pellicle was formed. In order to obtain the chlorate in small crystals the liquid was cooled suddenly. The mother liquor was removed by aspiration. The chlorate was washed three times with ice cold water. After drying over sulphuric acid there remained 40·336 grammes of chlorate of silver, white and unalterable in the light. The washing waters and mother liquors yielded 27·581 grammes of salt equally white and unalterable in the light, but extraordinarily changeable by exposure to the air.

These 40·336 grammes of chlorate were added to the salt obtained from the 123·500 grammes yielded by the fourth operation. In order to free it from the perchlorate which, in spite of every precaution it might contain, I submitted it to the following treatment:—

It was dissolved in cold water, and the solution was mixed with dilute chlorine water until the very slight alkaline reaction which it at first possessed, had disappeared. The liquid was then boiled to precipitate the traces of chloride of silver thus produced. The clear liquid was then decanted, evaporated over a water-bath till a pellicle formed, and cooled quickly. The mother liquor was removed by aspiration, and the crystals washed with ice cold water; all the washings, except the first, were evaporated, till a pellicle formed, and the same treatment pursued in their case. After repeating the crystallisations, the washings, and evaporations, I suc-

* The binoxide of manganese employed in the preparation of chlorine, after being finely powdered, was treated with dilute, boiling sulphuric acid so as to completely free it from the nitro-compounds which it always contains; it was then washed in pure water. This treatment is indispensable when chlorine is required absolutely free from chloride of azotyle.

ceeded in obtaining from the 123·5 grammes originally taken about 99 grammes of chlorate of silver, which I consider is as pure as can possibly be obtained. The mother liquors, which I carefully kept separated, yielded pure chlorate to the last trace. The preparation of chlorate of silver in the manner above described, I consider to be the most laborious and delicate operation which can be performed in analytical researches.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Fatigued with wandering from case to case to make comparisons between English and foreign manufacturers (for, owing to the perhaps inevitable distance between them, your correspondent at times has had to walk miles in this way), it was a relief to come at last to a case where attempts at comparison would have been useless. I allude to the, in many respects, unrivalled display of Messrs. Howard and Sons, of Stratford. Their name has for many years held an enviable position with regard to the purity and beauty of their chemicals, and the contents of their case fully sustain their old reputation. In the English catalogue they are described thus:—"48. Howard's and Sons, Stratford, near London, salts of quinine, and other chemicals."

Among the many remedial agents which organic chemistry has afforded us, quinine occupies the first place, chloroform the second. Without quinine, large tracts, indeed whole countries, would be simply uninhabitable for Europeans. To the backwoodsman a supply of quinine is as important as gunpowder. The "quinine famine" in the Mauritius demonstrated to thousands how small a thing even gold itself might become in comparison with the life-saving salt.

If the search for artificial quinine has been as unsuccessful as that for the Philosopher's Stone, it has at least resulted also in some great discoveries. It does not appear to be generally known that the first of the aniline colours was discovered during a search for artificial quinine! But, tired of waiting for that which did not come, finding that chemists could not produce quinine, it struck certain minds that it would be a surer plan to assist Nature a little, and Nature, as she always does when properly called upon, responded liberally. In effect, owing to the wasteful and ignorant manner in which bark was collected in its old habitat, it was, especially in the finer and richer varieties getting scarcer, this circumstance has induced certain enterprising men to cause the cinchonas to be introduced into India, and it has not only been found that the change of habitat does not prevent the development of quinine, but the valuable discovery has been made by McIvor, and confirmed by De Vrij, that covering the bark during its growth with moss increases the percentage of alkaloïds. The cinchona plantations in India are now so flourishing that there need be no apprehension of the supply of quinine ever failing, and if the discovery of artificial quinine should ever now be made, it would have to depend upon its value for its cheapness. We are aware that the discovery of artificial quinine has more than once been announced, but up to the present time such announcements have never been supported by positive evidence.

Messrs. Howards show an unrivalled collection of barks including several from the new Indian plantations, and a specimen grown in England by Mr. J. E. Howard. It is exceedingly interesting to find that this English bark, also contained quinine, for a specimen of the alkaloïd extracted from it and its sulphate are exhibited. In addition to the above this remarkable case contains specimens of the following alkaloids or their sulphates:—

Quinine	$C_{20}H_{24}N_2O_2$
Quinidine	$C_{20}H_{24}N_2O_2$
Cinchonine	$C_{23}H_{24}N_2O$
Cinchonidine	$C_{20}H_{24}N_2O$
Aricine	$C_{23}H_{26}N_2O_4$

It appears to your correspondent that an attempt to convert quinidine, cinchonine, or cinchonidine into quinine would be far more likely to meet with success than any efforts to produce that alkaloid by building it up step by step, and considering the enormous quantities of cinchonine which have been accumulated by quinine manufacturers, and are almost valueless, it is evident that such a discovery, however hopeless it may look at present, is well worth an effort. It must not be forgotten moreover, that researches of this kind, if carried on by competent persons, are certain to be fruitful in discoveries; even if the great end sought for be not attained. The admirable experiments of Pasteur are quite enough to prove the truth of this assertion.

In addition to the above, Messrs. Howard exhibit numerous chemicals of the highest possible quality. Amongst them is benzoic acid, on the perfect purity of which they pride themselves. It is free from the slightest admixture of the hippuro-benzoic acid, made by boiling hippuric acid (from the urine of cattle) with hydrochloric acid. This artificial benzoic acid is largely imported from the continent and sold as the genuine article. The acid thus produced is, however, never quite free from the peculiar odour of the urine of herbivorous animals, and, no matter how carefully purified, is without the fragrance which characterises it as obtained by sublimation from gum benzoin. This has induced some unscrupulous persons to mix a portion of the acid from benzoin with that from urine, in order that the fragrance of the one may carry the other off.

The tartaric and citric acids exhibited by this firm are in superb crystals and have the appearance of being in the highest possible state of purity.

A curiosity in its way is carbonate of ammonium, prepared entirely from volcanic products, and therefore free from the impurities of which traces are almost always to be found in the salt as obtained from the crude sulphate of ammonia of the tar distilleries. As is well known, crude boracic acid from Tuscany often contains borate, sulphate, and chloride of ammonium. One sample analysed by Wittstein contained no less than eight-and-a-half per cent of sulphate of ammonium. The carbonate of ammonium shown by the Messrs. Howard is obtained in their process for preparing borax from the crude boracic acid of commerce, and is therefore, as they say, of purely volcanic origin. We believe there is no other firm who prepare salts of ammonium from the same source, The morphia and its salts shown in the same case appear of very fine quality, and the same remark may be made with regard to their mercurial preparations. I am much pleased to see that the admirable display I have described, had obtained the distinction of a gold medal.

Popular Scientific Information.—The following paragraph, from the pages of a weekly contemporary which makes great pretensions to accuracy, shows the kind of science on which the mining public are fed:—"An invention has been provisionally specified by Mr. Bonneville, of Paris, for obtaining white lead direct from the ore, by pouring the molten metal into cold water, to render it as porous and bulky as possible; it is then dissolved in sulphuric acid, and the sulphate is treated with pyroligneous or oxalic acid, combined or not with tincal dissolved in water, and next dried over the fire on ways. The vessels employed are either made of stone of wood, lined with lead, which become coated with a protecting covering of lead."

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, Aug 13, 1867.

Mother of Pearl Colours applied to Porcelain.—Improvements in Calico Printing.—Engraving on Glass with Hydrofluoric Acid.—Polychromic Impressions on Porcelain.—The Spherometer.—The Exhibition Awards.—Security from Fire.—Steel Wire Drawing.—Cheap production of Oxygen.—Bleaching with Fluosilicic and Sulphurous Acids.

We have already mentioned that the Society for the Encouragement of National Industry holds, during the Exhibition, weekly instead of monthly meetings.

At the meeting on July 26, M. Maillard invited the Society to attend his experiments on the next day, at Avenue Montaigne, No. 21, Paris, to show the superiority, as regards security from fire, of his mineral roof-sheeting, compared with that of zinc or tiles. [We learn since that the tiles and zinc gave way at once, while the new mineral covering resisted the effects of fire.]

M. Lavollée read, in the name of the Committee of Commerce, a report by M. Legentil on the manufactory of M. Teste, established at Lyons, for steel wire-drawing, in which he employs infirm workmen. This establishment has quintupled its importance in spite of the reduction of the prices resulting from the treaties of commerce, it has more extended relations with foreign countries, and in it are fabricated all important objects of steel wire-work; needles, umbrella-ribs, knitting-needles, crochets, enamelled-headed pins, pivots for different trades, springs for crinolines and corsets, &c. M. Teste announced that he employs 246 workmen and workwomen, 100 of which are employed at their homes. Besides these latter he employs about 120 young infirm females who have found a refuge in a religious institution, established near his works, and called the Sainte-Elizabeth Providence of the infirm.

On the 2nd of August, 1867, M. Chevallier in the chair, a meeting was held in which M. Salvetat presented a report on mother-of-pearl colours applied to the decoration of crystal and porcelain, made by M. Briançon, decorator, Paris. He remarked that the pearl varnishes of M. Briançon were eight years ago objects of examination and encouragement on the part of the Society. Since then the method has been extended to new applications, and has met with much encouragement abroad; thus we observe in the Exhibition a great number of pieces of pearly porcelain in the Belgian, Italian, Spanish, Prussian, Austrian, and Russian sections. The employment of bismuth for this purpose originated, according to Mr. Salvetat, in France.

M. Schutzenberger, professor of chemistry at the College of France, gave a very interesting lecture on his improvements in the printing of woven stuffs during the last few years. The mechanical principles adopted are the same as formerly; the means of engraving the plates have been much improved, and blocks of fusible metal are now oftener employed; also, the impression by engraved rollers has come more generally into use. Machines have been constructed for printing at one operation eight to twelve colours, and in England they go as far as twenty-four colours. The rollers are of cast iron covered with copper, and the engraving is made by the ordinary means of aquafortis; the chemical processes were the object of more extended study, since eight or twelve colours have to be fixed on the tissue by one and the same means, as they are applied simultaneously. Albumen is one of the substances most generally used. It coagulates at the boiling point of water, and retains and fixes on the tissues the colouring matter with which it is charged; it also forms a mordant for applying, on cotton, colours derived from aniline which can only be fixed by nitrogenized substances. The lecturer detailed also the processes employed in the use of garancine or madder colours, and went into a very ample description of aniline colours and their improvement, and he dwelt upon the stability and indestructibility of aniline black.

M. Peligot, member of the council, explained the processes generally in use, for engraving on glass by hydrofluoric acid. This acid in a liquid state gives a polished and transparent surface to the glass, and is useful for making decorative designs on white glass lined with coloured glass. Dull engravings on glass are obtained by the use of neutral fluorides, to which acid has been added. M. Kessler applies these processes at Baccarat; they are also used at Saint Louis. This last establishment consumes annually 800 kilog. of hydrofluoric acid; Baccarat employs more. The designs are first drawn on stone, and proofs are taken off with an ink containing wax and bitumen, on unsized paper, coated with starch first, then with gum, and thirdly with collodion. When the sheet is applied to the glass, the paper is washed off with water, leaving only the impression and the coating of collodion which covers it. A similar proceeding is employed for polychromic impressions upon porcelain, the collodion being burned off in the fire. Five hundred large sheets of glass engraved in this manner measuring 2m. 20c. long by 60c. wide, have been made, for the establishments of M. Duval in Paris.

M. Perreux, engineer, explained the principles of his *spherometer*. It consists of a screw, the pitch of which is a quarter of a millimètre, and a circle divided into 500 parts, so as to obtain the graduation of 1-2000th of a millimètre. He also explained the construction of a self-acting machine, capable of marking, in a right line, divisions visible by the microscope, only the thousandth part of a millimètre asunder.

Among the many persons of great merit in the French section of the Exhibition who have been either badly rewarded, or passed over in silence, we cite the following: M. Collas, the pioneer of benzol, inventor of nitro-benzol, and classed by the Society of Mulhouse among the discoverers of aniline colours; he has exhibited at the Paris Exhibition two important discoveries, and the jury have not awarded him even honourable mention. What has become of the medal certainly awarded to him by the jury at the first meetings?

M. Dubrunfaut, discoverer of the application of osmose to the extraction of sugars, exhibited by M. Camichel de la tour du Piu (Isere), a successful operation, greatly extolled in three lectures, by M. Payen, a most excellent judge, at the *Conservatoire des Arts et Metiers*, at the Sorbonne, and at the Society of Encouragement, has been completely ignored.

The "Mille" gaz, and gazo-lamp, the former of which is remarkable for the facility with which gas is produced without any mechanical agent or fire, by an apparatus easily put up anywhere; and the latter now sold by thousands all over Paris and in the Provinces, besides being exhibited in hundreds of different shapes and designs at the Exhibition, do not figure even in the catalogue.

A noble widow, Madame de Clercq, spent £140,000 in order to render the commune of Oignies, in the Pas de Calais, in which she resides, a terrestrial paradise. She has constructed at her expense a vast church, an asylum, a school and work-room for girls, a boy's school, a house of patronage for youth, an asylum for the aged, cheap dwellings, &c.; she has founded courses of studies for adults, Sunday-schools, a library, a club, recreation and exercise rooms, with medical consultation, a savings' bank, &c. A group of neighbouring roads has also been organized and kept in repair, more than 400 acres of land have been cleared and let out to 550 families, a coal mine has been sunk, and water supply given to the town, now numbering 1800 souls, all at the expense of this lady, to whom the jury have awarded the humble prize of a silver medal!

The aim of the Agricultural Society of Entomology is to contribute to the multiplication of useful insects, and to promulgate the means of destruction of noxious

ones. It is composed of honorary and titular members, without any limit as to their number. The title of honorary member can be conferred on persons who, by their publications and works, forward the views of the Society. It can be also conferred upon persons who aid the Society by their patronage or donations.

Any person, without distinction of residence or nationality, can be received as titular member and correspondent of the Society, by being presented by a member of the Council, adhering to the statutes, and paying ten francs per annum. From time to time reports are issued relative to the multiplication of insects useful to man, and the destruction of those hurtful, indicating the rational means of healthy development; in the other case the most ready method of extirpation. There are being formed a library, collections, and a museum; also, the documents and papers received are centralised and classified, and those intended for publication are indicated. An enquiry office has been instituted, in which interested parties can obtain information on the insects about which they desire it.

Every two years an exhibition is organised, in Paris, of useful insects, their products and apparatus adapted to their cultivation; and of noxious insects, the ravages caused by them and their means of destruction.

The process for the cheap production of oxygen by M. Tessie de Motay, has perfectly succeeded in the laboratory of the Exhibition established on the banks of the Seine. The new method, so simple and efficacious, has fulfilled all expectations. Fifty kilogs. of manganate of soda give 400 to 450 litres of oxygen per hour, after eighty successive re-oxidations. M. Tessie de Motay has so perfected the fabrication of manganate of soda, that he is almost certain of being able to furnish it to the trade at the price of 30 or 40 centimes the kilogramme. The necessary arrangements for essaying on a large scale the oxyhydrogen light at the Hotel de Ville, in the square as well as in the interior, advance rapidly, and the generators are fitted up already in the cellars. Oxygen and common gas burned together in common burners increase the illuminating power from 1 to 8 or even 15, or can serve at the same time for burning in the chloride of magnesium lamps of M. Carlevaris, which do excellent service.

In order that the essays of spontaneous bleaching with fluosilicic acid and sulphurous acid could completely succeed, it was necessary to render as cheap as possible the production of manganate of soda. Applied to pulp of wood and straw it gave such excellent results that the manufacturers themselves scarcely knew whether they were treating rag-pulp or straw-pulp. F. MOIGNO.

REPORTS OF SOCIETIES.

ACADEMY OF SCIENCES.

AUGUST 5, 1867.

(FROM OUR OWN CORRESPONDENT.)

Fall of Aerolites.—Ozonometry.—Oxide of Thallium a Test for Ozone.—Theory of Solar Spots.—Wax of the Fig Cochineal.—Moulting of Fishes.

The minister of public instruction transmitted, on behalf of the Algerian Government, several documents relative to the fall of aerolites which took place on the 9th of May, 1866, preceded by the appearance of a *bolide*, or meteor, which exploded with very loud reports.

Dr. Besigny presented a memoir on ozonometry, being a *resumé* of observations made during a period of nine consecutive years with iodized paper much more sensitive than that of Schönbein, and a scale of shades drawn up in concert with M. Salleron. The following are the principal results obtained at Versailles; the month of May is that during which the maxima are absolute, in November the absolute minima take place. At the equinoctial periods, March and September, ozone attains its relative maxima. The importance of the months is ranged in the following progressive order: May, March, April, June, August, July, September, January, December, October, February, and November. The comparison of the ozonometric curves with the meteorological charts of the observatory show that a maximum of ozone corresponds with the presence of a storm in Europe, on the Atlantic, or on the coasts of France and England. Certain minima follow the same law; but then it happens always that the storm is thrown back towards the south before reaching the meridian of Paris, and that it traverses Spain and the Pyrenees to extend itself over the Mediterranean. The coloration is generally very strong when the storm traverses France and England; it is also produced when it passes very high in the north. It varies with the intensity of the atmospheric movement, and with the distance at which the centre of this movement passes.

Dr. Besigny laid on the table a copy of the researches made on ozone, read by M. Schönbein at one of the meetings of the Scientific Association of France, held at Metz. The following is an extract:—Ordinary oxygen is without action upon the protoxide of thallium, while ozonized oxygen combines rapidly with this oxide so as to form the peroxide of thallium, which is brown. Paper steeped in a solution of oxide of thallium and exposed to free air, would be an excellent ozonometric paper if the carbonic acid of the air did not transform the oxide into carbonate, which passes more slowly to the state of peroxide, and blackens with difficulty under circumstances where strips of paper, iodized and starched, become coloured at the end of a few minutes in an atmosphere which contains a 1-2,000,000th part of ozone. The comparison between the two papers has at least the advantage of proving that the coloration of the iodized paper is really produced by the atmospheric ozone.

In an answer made by Mr. Faye to the objections urged, in April last, by M. Kirchhoff, against his theory of solar spots, he stated the question in the following terms:—"Admitting that the solar spots are simple 'daylights' (they are assuredly only cavities), in the luminous clouds which constitute the photosphere, to explain how it happens that we do not perceive through the cavity the whole body of the sun (150,000 leagues thick), the internal face of the photosphere on the opposite side of the celestial body in all its brightness." Again taking up the discussion, M. Faye calculates the tajectory of the luminous ray starting from that portion of the photosphere opposite to the eye which regards the spot, and thinks that he can prove by a very simple analysis, by supposing the obscure mass of the sun to be perfectly transparent, this portion of the photosphere would remain invisible. The reason of this is that the luminous ray would describe a spiral curve without ever coming out. Examining, then, the English theories, which pretend to explain the spots on the sun by its atmosphere, the influence or position of the planets, the intervention of cometary or meteoric matter, he demonstrated that these three causes are totally insufficient and inadmissible, inasmuch as they imply the existence round the sun of an atmosphere the thickness of which is one-third of the solar radius.

M. Blanchard presented a note from M. Targioni Tozzetti, professor at Florence, on the wax produced by the fig cochineal (*coccus coricæ*), which contains half its weight of ceroline, and can be abundantly procured and used in the industrial arts.

M. Blanchard also presented a note on the moulting of fishes, by M. Baudelot. Tubercles are often observed on the skin of fishes, accompanied by the falling off of the scales; these were sometimes considered as characteristic of a new species of fish. M. Baudelot has found that they are periodical, and are to be found in certain seasons of the year, thus constituting a true moulting.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Oenanthylidene and Caprylidene. — E. Rubien. Oenanthylidene, C_7H_{12}, is prepared by heating oenanthylenic chloride with twice its volume of a strong alcoholic solution of potassic hydrate, first under ordinary pressure, and afterwards in sealed tubes to 150°, repeating the treatment again and again, until the greater part of the oil, which separates on addition of water, distils below 120°. From this portion the pure oenanthylidene is obtained after repeated fractional distillations, boiling at 106°—108°. It is a colorless, thin liquid, lighter than water, rapidly volatilising at ordinary temperature, burning with a luminous flame, and dissolving in ether, alcohol and benzol. Bromine gives rise to two substitution-compounds—$C_7H_{12}Br_2$ and $C_7H_{10}Br_4$, the latter only having been obtained pure. Caprylidene, C_8H_{14} is obtained from caprylenic bromide by the same process, the reaction taking place somewhat more readily. Bromine produces the compound $C_8H_{14}Br_4$, which on being treated with alcoholic potassic hydrate is converted into $C_8H_{11}Br$. —(*Ann. Chem. Pharm.* cxlii. 294.)

Trichlordracylic acid.—P Janasch. A boiling mixture of potassic bichromate and diluted sulphuric acid (1 acid to 1 water) converts the solid trichlortoluol (fusing at 75°—76°) into trichlordracylic acid, $C_7H_3Cl_3O_2$. The acid melts at 160°, is readily soluble in alcohol and ether, sparingly so in hot, almost insoluble in cold water. The baric salt crystallises in long needles, and has the composition $(C_7H_4Cl_3O_2)_2Ba''$. (*Ann. Chem. Pharm.* cxlii. 301.)

Trixylylamine.—P. Janasch. This body is formed when chlorxylol (boiling at 200°) is heated with alcoholic ammonia in sealed tubes to 100°. For its separation, the alcohol has to be boiled off, and ammonic chloride removed by washing with water; the remaining oil is then treated with chlorhydric acid, and extracted with ether, the latter dissolving an oily body of, as yet, unknown nature. Trixylylaminic chlorhydrate is insoluble in ether or water, but soluble in alcohol, fuses at 203°—204°, and has the formula $(C_8H_9)_3N,HCl$. Sodic hydrate precipitates the free base, trixylylamine, as a thick oil, heavier than water, not solidifying at −15°.—(*Ann. Chem. Pharm.* cxlii. 303.)

Methylsalicylic acid, formation of.—C. Graebe. The similarity in the behaviour of the hydroxyl-group in phenol and in gaultheria-oil led to the belief that analogous to the synthesis of salicylic acid (Kolbe and Lautemann) oxyphtalic acid might be obtained by acting upon gaultheria-oil with sodium and carbonic anhydride, the reaction might be expected to proceed according to the equation:

$$C_6H_4\begin{cases}OH\\CO_2CH_3\end{cases}+CO_2=C_6H_3\begin{cases}OH\\CO_2H\\CO_2CH_3\end{cases}$$

No acid of the composition of oxyphtalic acid, however, was formed, but salicylic and methylsalicylic acid instead. As carbonic anhydride does not take any part in the reaction, the effect of sodium alone on methylic salicylate had been tried, and it was found that at ordinary temperature the methylic ether of sodiosalicylic acid

$$=C_6H_4\begin{cases}ONa\\CO_2CH_3,\end{cases}$$

and at 200°—220° sodic methylsalicylate

$$=C_6H_4\begin{cases}OCH_3\\CO_2Na\end{cases}$$

besides a small quantity of methylic methylsalicylate and sodic salicylate is formed.—*Ann. Chem. Pharm.* cxlii. 327.

Hydrophtalic Acid.—C. Graebe and O. Born. Benzol, although a saturated compound, is capable of uniting with two, four, or six monovalent elements, or groups of elements, thus forming the so-called products of addition of the aromatic series which possess the common property of being more or less easily reconverted into compounds of the benzol type. None of these bodies, however, with the exception of quinic acid (*Ann. Chem. Pharm.* cxxxviii., 197), have been sufficiently studied to afford a clear insight into their constitution. The present contribution contains the results of the author's researches on the addition of hydrogen to phtalic acid.

Hydrophtalic acid is prepared by adding sodium-amalgam to a solution of 1 part of phtalic acid, 1 of crystallised sodic carbonate, and 8 of water; the acid is then precipitated with chlorhydric acid, recrystallised and decolorised by means of animal charcoal. It is sparingly soluble in cold water and ether, more readily in alcohol and hot water; it may be heated to 200° without decomposition; being a bibasic acid, it forms neutral and acid salts, several of which are described. The decomposition which hydrophtalic acid undergoes with various reagents are shown in the following equations:—With soda-lime:

$$C_6H_6(CO_2H)_2=\underset{\text{Benzol.}}{C_6H_6}+H_2+2CO_2$$

with phosphoric pentachloride:

$$C_6H_6(CO_2H)_2+2PCl_5=$$
$$=\underset{\text{Benzoylic chloride.}}{C_6H_5(COCl)}+CO+3HCl+{}_2POCl_3$$

with sulphuric acid:

$$C_6H_6(CO_2H)_2+SH_2O_4=\underset{\text{Phtalic acid.}}{C_6H_4(CO_2H)_2}+2H_2O+SO_2$$

and

$$C_6H_6(CO_2H)_2=\underset{\text{Benzoic acid.}}{C_6H_5(CO_2H)}+CO+H_2O$$

with bromine:

$$C_6H_6(CO_2H)_2+Br_2=C_6H_5(CO_2H)+{}_2BrH+CO_2$$

with fusing potassic hydrate:

$$C_6H_6(CO_2H)_2=C_6H_5(CO_2H)+CO_2+2H$$

with nitric acid, or potassic bichromate and sulphuric acid, benzoic acid is principally formed. Heated by itself to above 200° hydrophtalic anhydride is obtained. Chlorhydric acid acting upon an alcoholic solution of hydrophtalic acid does not produce the ether of the latter, but benzoic ethide.—(*Ann. Chem. Pharm.* cxlii. 330).

Thallic Acid.—According to E. Carstanjen, thallic acid is formed when a current of chlorine passes through a hot solution of potassic hydrate containing thallic oxide in suspension, the liquid at the same time assuming a crimson colour. The solution may be evaporated and even filtered through paper, without undergoing decomposition; acids decompose the new compound, setting free oxygen. Further details are promised.—(*Journ. Prakt. Chem.* ci. 55).

Molybdates.—F. Ulik finds that there are six series of molybdates, corresponding to the general formulæ:—

1.	MO,MoO_3+nHO	4.	$MO,3MoO_3+nHO$
2.	$MO,2MoO_3$	5.	$MO,4MoO_3+nHO$
3.	${}_3MO,7MoO_3+nHO$	6.	$MO,8MoO_3+nHO$

Those hitherto known belong to series 1, 3, and 4. The salts of the 4th and 5th series appear in two modifications, a crystalline and an amorphous.

It is further shown that a decided analogy exists between molybdic, chromic, and sulphuric acid, the first forming a magnesic salt analogous in composition to the corresponding sulphate; and in the double salt $KO,MgO,2MoO_3$, one half of the molybdic acid may be replaced by chromic acid.—(*Journ. Prakt. Chem.* ci. 61).

Methoxybenzoic Acid.—C. Graebe and O. Schultzen. It has been shown (*Ann. Chem. Pharm.* cxxxix. 134) that the body obtained by acting upon gaultheria-oil with potassic hydrate is potasso-salicylic methide, and that the latter may be converted into methylesalicylic acid; it has likewise been proved that paraoxybenzoic acid, by the same reaction gives rise to the formation of sodioparoxybenzoic ethide and anisic acid. The object of the present

communication is to show that oxybenzoic acid, as regards the derivatives mentioned, behaves like its two isomers.

Oxybenzoic acid, prepared with unimportant modifications according to Fischer's method (*Ann. Chem. Pharm.* cxxxvii. 137), is heated together with potassic hydrate and methylic iodide in sealed tubes, to 140°, when the following reaction takes place :—

$$C_6H_4\begin{cases}OH\\CO_2H\end{cases}+2CH_3I+2KHO=$$

$$=C_6H_4\begin{cases}OCH_3\\CO_2CH_3\end{cases}+2KI+2H_2O$$

The methoxybenzoic methide thus formed is treated with potassic hydrate, and thereby converted into methoxybenzoic acid

$$=C_6H_4\begin{cases}OCH_3\\CO_2H\end{cases}$$

The acid is readily soluble in hot water, from which it crystallises in long white needles; it is also soluble in alcohol and ether; it fuses at 95°, and sublimes without decomposition. The argentic salt $=C_8H_7AgO_3$ is obtained as a white precipitate, soluble in hot water. —(*Ann Chem. Pharm.* cxlii. 350.)

NOTICES OF BOOKS.

Elements of Chemistry, Theoretical and Practical. By William Allen Miller, M.D., LL.D., Treasurer and Vice-President of the Royal Society, Vice-President of the Chemical Society, Professor of Chemistry in King's College, London, &c., &c. Part I., Chemical Physics. 4th Edition, with additions. 1867. (Longmans).

For the last dozen years Professor Miller's book has been the most important of English manuals of chemistry. Smaller and cheaper works have indeed very frequently supplied its place to the beginner and the non-professional student; and the advanced chemist has been constantly compelled to resort to the elaborate, though somewhat inconvenient, handbook of Gmelin. But for ordinary use by the advanced student, the manufacturer, the general reader, and the professional chemist, "Miller" has been the almost invariable guide. It is looked upon by most English chemist with a kindly regard, derived partly from familiarity, but even more from gratitude. No one can estimate the importance to the progress and spread of a science, of a well-written, lucid, and comprehensive manual. Sciences which are not so provided are sure to languish, if not in development, at any rate in popular estimation and general cultivation.

Very peculiar qualifications are necessary for the successful compilation of such a manual. The author must be a man of original genius as well as of deep and varied knowledge. He must be unprejudiced and tolerant in his judgment, able to see the fragmentary truth in two contending views, and able, also, to sift contending evidence—the amount of which is unfortunately always immense,—and, without dogmatising, to note the probabilities to which it points. And, finally, to render his labours of much avail, he must be a man of mark in his science—one whose researches and experience are sufficient to stamp his opinions with some authority. It is not good that he should be too closely bound to any one of the fleeting systems of science. He must be an exponent, not an advocate, using new theories and crude, half-proven facts with the cautious hand of one who knows how soon they may be swept away. His duty it is to write,

> "Not clinging to some ancient saw;
> Not mastered by some modern term;
> Not swift, nor slow to change, but firm
> And in its season bring the law
> That from Discussion's lip may fall—"

surrendering the most cherished of his convictions, the most habitual of his modes of expression, the moment the growing mass of scientific fact shall point it out as desirable.

It is unnecessary to point out how well Professor Miller fulfils these hard conditions. There is probably no chemist in England less dogmatic in his tone of thought, or less wedded to any particular system. The present edition of his "Manual" affords, we are happy to say, a most convincing proof of this, if any proof were still wanting. Just at the juncture when the interests of chemistry required it, when the revolution which began with the petty insurrection of O = 16 against O = 8, is completing itself, and when something like consistency is once more apparent in the language of chemical journals, this new edition appears, and we find that the author, instead of endeavouring to patch up an effete doctrine, has given in his adhesion to the new, and formally ranged himself under its banners.

Every chemist knows the book so well that it would be absurd to offer more than a few passing comments upon it. The present volume, occupied almost entirely with physics, is but little changed by the alteration in nomenclature and notation. The introductory chapter has been chiefly re-written, and although the author, with characteristic caution, stops short of the extreme development of the most modern theorists, his sketch of the laws which govern the operations of chemical force is perfectly in accordance with modern doctrine, while it preserves the admirable lucidity which distinguished previous editions. As in Hofmann's little book, the term "equivalence" is used instead of "atomicity," which is decidedly barbarous, and is, moreover, open to the charge of implying more than can be proved.

The general plan of the volume has been but little altered, though a good many additions have been made to it. The section on the photographic action, of light has, very wisely, been transferred from the second volume, and is a most valuable summary of the present state of knowledge upon the subject. Spectrum analysis is, of course, enlarged, and is prefaced by a useful sketch of the history of the subject. The recent researches of Dale and Gladstone, and of Landolt, upon the connection of optical properties with chemical composition, are shortly described. The wonderful results of Graham on the absorption of gases by metals have been inserted, although his last extraordinary experiment, in which hydrogen was separated from a meteorite, was not announced until the volume was in print. In the chapter on electricity we find clear descriptions of the magneto-electrical machines of Holmes and Wilde, although the curious electrical machine of Holtz is unaccountably omitted. The conclusions of the British Association committee on the standard of electrical resistance have been inserted in some detail, well warranted by their extreme importance.

The above are, we believe, the most important of the additions which distinguish this edition. Of course there are a few omissions to notice: it would be a strange thing if there were not in a work upon so wide a plan. We regret the absence of Stokes's beautiful and simple methods for the spectroscopic examination of liquids, and their extensions by Sorby, though perhaps the latter belongs more properly to microscopy. And, to select another illustration, it would surely have been well to have given some account of Balfour Stewart's striking experiment on the rotation of a disc *in vacuo*, for although its present explanation must still be regarded as hypothetical, it is in the highest degree suggestive. These, and a few more of the same kind, are, however, but specks in a most excellent work, and we cannot conclude without congratulating the author on the care and skill with which he has moulded the successive editions of his book into harmony with the rapid strides of science.

CORRESPONDENCE.

COMMERCIAL ANALYSES.

To the Editor of the Chemical News.

Sir,—Some months ago we heard a little on this matter in your columns. Are we always to be annoyed by these discrepancies? I have just incurred two fees to two separate chemists of large experience in analysing artificial manures, one "high" and the other "low." These two gentlemen have operated on portions of the same fairly drawn sample of superphosphate; the difference between them is only seven per cent! As a seller, of course I shall believe the "high" analyst, and when I am purchasing goods I shall, for as obvious a reason, employ the "low" man.—I am, &c., Simon Simple.

MISCELLANEOUS.

The Earliest Universal Exposition of which we have any record, was held at Rome, in the days of Nero. The philosopher and moralist, Seneca, gives the following account of it: "I was present, the other day, at a solemn exhibition of the wealth of Rome; where I saw statues which were marvels, perfect masterpieces; exquisite stuffs and draperies, and costumes brought from countries even beyond the Roman frontiers," etc.

Nitro-Glycerine in Blasting.—A correspondent of the Nevada *Gazette*, who has recently visited the summit tunnel on the Central Pacific Railroad, writes that the contractor thinks they are going ahead with the tunnel fully twenty-five per cent faster by the use of nitro-glycerine than they could by using powder. The small holes required for the oil can probably be drilled in less than one-third the time required for larger ones necessary in using powder. The oil does much more execution than powder, as it always breaks the rock from two to sixteen inches beyond the hole, and also throws out a much larger body. The oil, in hard rock, shows a strength five times greater than powder, pound for pound It is made upon the spot, and is considered much stronger, as well as safer, than that imported. They have now been using it for several months, and have never yet had a premature explosion, or any other accident, and not a single blast has missed fire since the Chinamen commenced filling the cartridges. The work upon this road seems to have fully set at rest the superiority of nitro-glycerine over powder, both for economy and safety. Of course this applies to the oil made upon the spot, and not to the imported article.

Clarifying Action of Sulphate of Alumina on Turbid Water.—Whatever be the nature and quantity of the earthy substances held in suspension in turbid water, it becomes fit to drink in from seven to fifteen minutes if to each litre there be added ·04 grammes of finely-powdered alum, care being taken to agitate the liquid when the alum is introduced (this is about ½ lb. per ton of water). If potash alum is used the alum is decomposed into sulphate of potash, which is all dissolved by the water, and sulphate of alumina, which, by its decomposition, purifies the water. The alumina separates in an insoluble form, and carries down with it as it precipitates the matters which render the water troubled, and the organic matter. The acid attacks the alkaline and earthy carbonates, and transforms them into sulphates. The water becomes slightly richer in bicarbonates and free carbonic acid, whilst all organic matter is destroyed. Seven parts of sulphate of alumina will purify as much water as ten parts of rock alum or potash alum, and the sulphate of alumina does not introduce any alkaline sulphate into the clarified water.—*Technologiste*, vol. xxiv., p. 197.

What is Fame!—The following extract from an *American* scientific paper somewhat surprises us. The only explanation we can offer is, that the paragraph was possibly translated from the *French*. "Offers of knighthood have been made and refused by several of the distinguished mechanics and men of science in Great Britain. James Watt refused knighthood, as did Michael Faraday. The latter commenced life as a poor mechanic, and worked up to the head of his profession; is an honorary member of the Institute of France, Fellow of the Royal Society, an able author on engineering subjects, and is the inventor of the cellular hollow girder system, upon which the Britannia tubular bridge is built."

How to Produce Stoneless Fruit.—At a late meeting of the Agricultural Society in India, the Rev. Mr. Firminger communicated a plan by which the stones of fruit may be reduced or made to disappear, and the pulp increased in size and flavour. At any time during the cold season select a branch that is to be used afterwards for inarching. Split it up carefully somewhat less than a span long. From both halves of the branch thus split scoop out cleanly all the pith; then bring the split halves together again, and keep them bandaged till they have become thoroughly united. At the usual time, the beginning of the rains inarch the branch thus treated upon suitable stock, taking for the place of union the portion of the branch just below where the split was made. Upon a branch of the tree thus produced a similar operation is performed, and so on for successive seasons, the result being that the stone of the fruit becomes less and less after each successive operation. This process has been applied likewise to the grape vine at Malaga, and plants thereby have been produced which bear the finest fruit, without the slightest vestige of a stone within them.—*Mining Press.*

Explosion of Gun-cotton.—On Monday afternoon an explosion occurred in a building used for the purpose of drying gun-cotton at the works of Messrs. T. Prentice and Co., Stowmarket. The building was a two-storied one, the bottom being built of clay lumps, and the upper part of wood with a lining, the space being filled up with sawdust packing. The roof was of slate. The building was situated near the bank of the river on the railway side, at the further end of the works. The custom has been to place the manufactured cotton in the building moist, and to subject it for a time to heat varying from 90° to 120°. This heat was imparted by means of pipes from an adjacent shed, in which were a series of stacks of horizontal pipes generating heat from steam conveyed to them by a pipe across the river. About 3 p.m. a loud, dull report was heard, followed by another sharper report, and the building attacked was levelled with the ground, while the ruins were in a blaze. The flames spread to another drying shed, in which was a quantity of the sheets of paper used in cartridges, hung up for drying. The roof of this shed was blown up, and the flames thence extended to some large tanks containing cotton in process of manufacture. Some of the covers were burnt, but the cotton was only blackened in places. Some trees on the railway side of the works were burnt and scorched, and some cattle belonging to Mr. Arnold Scuttle were badly burnt. No person was in the shattered buildings when the explosion took place, although two men named Conham and Broom had been in the drying shed a few seconds before the accident happened. The occurrence is attributed to over heating; the sun made the roof very hot, and the pipes forcing in more hot air, the temperature was raised to 170°, at which gun-cotton explodes.—*The Times.*

If 170° refers to Fahrenheit's scale it is entirely wrong. Professor Abel places the exploding point of gun-cotton at about 150° C., which is equivalent to 302°F.—Ed. C.N.

Legalised Poisoning.—It is high time that steps were taken to compel the Metropolitan Railway Company to supply their passengers with air which can be inhaled without danger to life. Travelling daily along that line, we have noticed for some months past that the atmosphere, especially between Baker Street and King's Cross, has been getting more and more foul, until at the present time it is almost unbearable. Sulphurous acid is almost habitually present in such quantities as to render breathing painful, and to induce a feeling of suffocation. That these statements are not exaggerated is proved by the shocking death which actually took place at one of these stations one day last week. The inquest was held by Dr. Lankester. The deceased, Sarah Dobner, whilst at the station complained of great difficulty of breathing, and said she was in great pain. A medical man advised her removal to the hospital, but it was then believed she was dead. Mr. Anderson, one of the surgeons at St. Mary's Hospital, who made the *post mortem* examination, said the deceased was labouring under disease of the bronchial gland, and undoubtedly the suffocating air of the Underground Railway had accelerated death. The coroner said he had experienced the depressing effect of that railway, and therefore avoided it as much as possible. The tunnels and stations should be ventilated, but he supposed that would not be done until some shocking loss of life from suffocation had occurred. The jury returned a verdict of "Death from natural causes, accelerated by the suffocating atmosphere of the Underground Railway." The Underground Railway is, however, not the only place where a neglect of the most ordinary dictates of common sense has occasioned loss of life. The *British Medical Journal* last week chronicled the poisoning of a young clerk by the bad atmosphere of a small telegraph-office room, ill ventilated, and with four gas-burners, of which "all the clerks had complained." This is only a rapid and compressed view of a tragedy constantly being worked out more slowly in work-rooms and offices, and approximately imitated by the poisoning and illness due to the bad ventilation of our gas-lit theatres, churches and ball-rooms.

Double Sesquichloride of Iron and Sodium.—I produced this combination, which as far as I know, is a new one, by the action of hydrochloric acid upon artificial ultramarine. The silicate becomes separated, and if water be added and the solution filtered, the double chloride in question, which is colourless, will be found in the filtrate. The following equation will serve as a further explanation :—

$$\left(\begin{matrix}Na_2\\Al\\Si_2\end{matrix}\right\} O_8 + Na_2O + FeS_3\Big) + 8HCl =$$

$$= \begin{matrix}Na_2\\Al\\Si_2\end{matrix}\Big\} O_8 + H_2O + 3H_2S + \begin{matrix}Na_2\\Fe\end{matrix}\Big\} Cl_8$$

By writing upon paper with the solution and afterwards warming it, the letters become black, just as in the case of some sympathetic inks. As the writing does not disappear again by the action of water, it is to be supposed that sesquichloride of iron and sodium is decomposed by heat.—*J. Landauer.*

The Standard Pound.—It appears from the reports of the Comptroller-General of the Exchequer that the Exchequer standard avoirdupois pound is actually at the present time in a most unsatisfactory condition, "oxidated on the surface, practically erroneous on the face of it, and known to be erroneous;" and as all the Exchequer standard weights are made of brass, a metal stated to be peculiarly liable to oxidation in the atmosphere of London, and described by Professor Miller as "quite unfit, unless well protected by gilding, to be used in the construction of weights having that degree of accuracy which is required in secondary standard," it is to be feared that others of these Exchequer standard weights may be wanting in accuracy.

Petroleum as Fuel.—The idea of employing petroleum as a substitute for coal in the generation of steam has for some time engaged the attention of scientific men in America, and recently, under the auspices of the Navy Department, a series of experiments on the subject has been carried on at Boston, and there seems a fair prospect that the investigations will result successfully. A gunboat called the Palos was used for the experiments. She had been built for the Government, to make a speed of eight knots an hour, and with coal could never be forced beyond that. First she was tied to the dock, and the possibility of getting up steam with petroleum was demonstrated. She was then sent on a trial trip down the harbour. Steam was got up with petroleum in 25 minutes, and the Palos steamed down the harbour and back, a distance of 25 nautical miles, in 1 hour and 55 minutes. In making this trip she consumed but four barrels of petroleum. The fires are reported to be kindled and extinguished with nearly the same ease as lighting and extinguishing a gas-burner. The furnaces of the Palos, originally built for burning coal, were fitted at comparatively small expense with burners to which the petroleum was led by pipes from the tanks on deck. The burners, by their own heat, turn the petroleum in the pipes into gas, and in this form it is burnt. The flames produced are intensely hot, and the petroleum burnt on the trip produced as much steam as 20 times its bulk in coals—a great saving of room in ocean voyages. The dangerous properties of the petroleum appear to be the only drawback to its use in this way, for coal-burning furnaces can be adapted to its use at but a trifling expense. The supply of petroleum is now so much greater than the demand that, even with three-fourths of the wells in the producing regions abandoned, it can be bought for 2d. a gallon. Its cheapness is therefore another strong inducement to use it for generating steam.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Annales de Chimie et de Physique. April, 1867.

C. Marignac, "On some Fluates of Antimony and Arsenic." Wyrouboff, "On the Optical Properties of some new Tartrates." F. Rossetti, "On the Maximum Density and on the Expansion of Distilled Water."

Bulletin da la Société d'Encouragement. March, 1867.

Puscher, "On a new Gold-coloured Lacquer for Brass Articles." "On the Extraction of Copper by Hydrochloric Acid as used at Braubach (Nassau)."

Annales du Génie Civil. May, 1867.

L. Droux, "On the Providencia Soap and Candle Works in San Sebastain, in Spain." N. Basset, "On G. Ville's Improved Artificial Manure." Paquot, "On the Use of Chloride of Barium for preventing the Formation of Boiler Scale." Libert, "On the Use of Catechu for preventing the Formation of Boiler Scale." Taskin, "On the Prevention of Boiler Scale." A. Souheur, "A new Petroleum Safety Lamp for Mines." "On the Use of naturally-formed Gas for Illuminating Purposes."

Dingler's Polytechnisches Journal. April, 1867.

C. Schinz, "On Lundin's Regenerative Gas Furnace." "On Regenerative Gas Furnaces as applied to the Manufacture of Glass." "On Lindner's Theory Respecting the Influence of the Form of Fuel on Combustion." L. Ramdohr, "On the Production of Gas from some of the Waste Products of the Manufactore of Creosote." E. Sostmann, "On the Use of Paraffin in the Manufacture of Sugar." J. von Liebig, "On the Diseases of Silkworms." Nessler, "On MacDougall's Disinfecting Powder for Stables."

April 13, 1867.

"On a Method of renevating Files by etching with Sulphuric Acid." A. Patera, "On the Electrolytic Precipitation of Copper from its Solutions." C. Aubel, "On a new Method of Extracting Copper from slags by means of dilute Sulphuric Acid." E. Brimmeyr, "On the different Processes for utilising the Refuse of the Fuchsine Manufacture, and for reobtaining the Arsenic Acid." L. Walkhoff, "On Dubunfaut's Method of obtaining Sugar from Molasses by Dialysis." J. C. Lermer, "On the Alkaloid of Beer."

PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

1412. H. A. Bonneville, Rue du Mont Thabor, Paris, "An improved washing powder." A communication from L. Lacalm, and B. A. Gayot, Aubin, France —Petition recorded, May 13, 1866.

1617. F. W. Dolman, Jermyn Street, Saint James's, Middlesex, "A new or improved method for obtaining an essential oil applicable as a curative agent or medicine in the treatment of inflammatory joint diseases, rheumatism, sprains, bruises, and similar ailments." A communication from L. Jamieson, Buxar, Bengal, India.—May 31, 1867.

1712. J. Graham, Banford, Gilford, Down, Ireland, "An improved mixture or composition for bleaching vegetable fibres."

1713. H. Fletcher, Old Hall Street, Liverpool, "Improvements in the manufacture of artificial fuel."—June 11, 1867.

1728. A. M. Clark, Chancery Lane, "Improvements in the manufacture and treatment of white lead, and in apparatus connected therewith."—A communication from R. G. Hatfield, New York, U.S.A.—June 12, 1867.

1747. J. Onions, Devon Place, Newport, Monmouth, "Improvements in the manufacture of steel."

1748. G. M'Kenzie, Glasgow, N.B., "Improvements in the manufacture of illuminating gas."—June 15, 1867.

1803. H. K. York, Cardiff, "Improvements in the manufacture of steel." June 20, 1867.

1819. G. Dickie, Kilwinning, Ayrshire, N.B., "Improvements in the manufacture of illuminating gas." June 21, 1867.

1836. J. K. Field, Upper Marsh, Lambeth, Surrey, "Improvements in the manufacture of candles."—June 24, 1867.

1845. J. Webster, Birmingham, "A new metallic zinc paint."

1846. J. Crow, West Ham, Essex, "Improvements in the manufacture of illuminating gas from gas tar oil, or from gas tar."

1850. L. Brunetti, Rovigno, "An improved process of embalming and preserving animal substances from decay, for anatomical purposes." —June 25, 1867."

1886. C. O. Heyl, Berlin, "An improved method of, and apparatus for, making sulrhuret of carbon."

1888. J. C. Sellars, Birkenhead, Cheshire, "Improvements in the utilisation of a certain waste material obtained in the manufacture of hydrocarbon liquids."—June 28, 1867.

1900. A. M. Fell, West Calder, Midlothian, N.B., "Improvements in purifying or preservative compounds to be applied to the fleeces or skins of sheep and other animals."

1905. W. H. Richardson, Glasgow, N.B., "A certain improved mode of manufacturing iron and steel."—June 29, 1867.

1950. A. E. Herrmann, Mincing Lane, London, "An improved lubricating compound." A communication from H. Waltjen, Bremen. —July 3, 1867.

2006. G. Gabillon, Rue Joqeelet, Paris, "A process to prepare and preserve paper and tissues with a solution of per-chloride of iron, intended for stopping the bleeding of wounds."—July 9, 1867.

2034. J. H. Johnson, Lincoln's Inn Fields, Middlessex, "Improvements in the manufacture of refined sugar." A communication from E. P. Eastwick, Baltimore, Ma., U.S.A.—July 11, 1867.

2046. J. Hargreaves, Appleton-within-Widnes, Lancashire, "Improvements in the manufacture of steel and soft iron from cast iron."

2055. A. E. Herrmann, Mincing Lane, London, "An improved compound to be used for igniting fires." A commnnication from H. Waltjen, Bremen.—July 12, 1867.

2100. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the treatment and purification of oils." A communication from F. Asselin, Paris, France.—July 17, 1867.

NOTES AND QUERIES.

Bone Boiling.—Can any of your readers tell me how to destroy the smell arising from bone boiling? or, can they inform me how to utilise size, the result of steaming bones? It is unfit for any stiffening process. If used in artificial manures how can it best be appropriated?—Oss.

Naphtha, *ναφθα* (No. 399).—This word, in the original Chaldee signifies *stillare*, to ooze or drop; the true naphtha has been found from the most remote ages exuding out of the earth in several places in Chaldæa. One of the tribes of the children of Israel were the Naphthali (Nephthalim, Rev. vii. 6), inhabiting the shores of the Caspian Sea. No doubt the name of the people was derived from their country producing naphtha.—Septimus Piesse, Ph.D.

Specific Gravity Problem.—Sir,—Your correspondent will find the specific gravity problem solved in the following lines:—Weight of meteoric stone in water:

$$= 50 - (50 \div 6{\cdot}1) = 41{\cdot}8$$

Weight of Olivine in Water

$$= 20 - (20 \div 3{\cdot}2) = 13{\cdot}75.$$

Substracting we obtain the weight in water corresponding to the 30 grains of dissolved matter 28·05.

Sp. gr. of matter dissolved out

$$= 30 \div (30 - 28{\cdot}05) = 15{\cdot}384.$$

F. J. R. C.

Specific Gravity Problem.—Sir,—The following formula will, perhaps, answer the purpose of *Sideros*:—Let A., B., C.; a., b., c. represent the weights (in any given unit) and sperific gravities of the compound and its two components respectively. Then assuming the volume of unit of weight of water as the unit of cubic contents, we have:

The cubic content of 1 unit of weight of compound body $= \frac{1}{a}$

" " " " A $= \frac{H}{a}$;

" " " " B $= \frac{B}{b}$;

" " " " C $= \frac{C}{c}$;

$$\frac{C}{c} = \frac{A}{a} - \frac{B}{b} = \frac{A\,b - a\,B}{a\,b}$$

$$\therefore c = \frac{a.\,b.\,C}{A.\,b - a.\,B}$$

In the present case the sp. gr. would be

$$\frac{3{\cdot}2 \times 6{\cdot}1 \times 30}{(3{\cdot}2 \times 50) - (6{\cdot}1 \times 20)} = \frac{575{\cdot}6}{38} = 15{\cdot}1458.$$

Lloyd.

Specific Gravity Problem.—Sir,—Your correspondent *Sideros* gives a most singular problem. Either it must be only a hoax, or else there is some radical error in his observations. If, instead of giving respectively the sp. gr. of the original substance and the remaining olivine, he had simply quoted their weight in water, it would have saved great trouble. But, notwithstanding the difficulty thus put into the question, I answer it according to his proposition, and the results induce me to believe in my first assertion, because iron of such a sp. gr. is preposterous. But here is my calculation, minus the method of finding the statements, which he omitted:—

Weight of the iron and olivine in air (original subst.) ..	50 grs.
" " " " " " water	8·1968
Weight of water equal in bulk to iron and olivine ..	41·8032
Weight of olivine in air	20 grs.
" " " water	6·24969
Weight of water equal in bulk to olivine	13·75031
Weight of water equal in bulk to iron and olivine ..	41·8032
" " " " " " " olivine	13·75031
Weight of water equal in bulk to iron	28·05289

Weight of iron in air 30

Weight of water equal in bulk to iron 28·0528 = 1·10506 = sp. gr. of the iron according to *Sideros*' proposition.—C. H. P.

TO CORRESPONDENTS.

To Philip.—*S.S. Narva.*—Yours arrived just before going to press. All well here Theory about water correct.

M. J. Salter; G. W. Wigner; O. James; Dr. C.; F. Dyer; and others.—Further information will be published in these columns as soon as anything is decided.

Errata.—Page 6, line 29, for *lower* read *higher*. In Dr. Miller's Lecture on "Spectrum Analysis," page 72, 1st column, 4 lines from bottom, for *humidity* read *luminosity*; 2nd column, 23 from top, insert *he* before *asked*; page 73, 1st column, 9 lines from top, for *newest* read *nearest*.

Books Received, "Report on the Sanitary Condition of the City of London," by H. Letheby, M.B.

"On the Laws of Connexion between the Conditions of a Chemical Change and its Amount," by A. Vernon Harcourt, M.A., and W. Esson, M.A.

"Abridgments of Specifications relating to Plating or Coating Metals with Metals."

Ditto, "Relating to Photography."

"On Some Points of Chemical Nomenclature," by A. Vernon Harcourt. M.A.

Meeting for the Week.—Quekett Microscopical Club.—Friday, August 23, at 8 o'clock—Mr. R. T. Lewis, on "A Microsopical Examination of 'Mermis nigrescens.'"

Communications have been received from Professor T. Hayter Lewis; H. Letheby, M.B.; A. Vernon Harcourt, M.A., (with enclosure); W. Esson, M.A.; W. H. Walenn (with enclosures); F. J. R. Carulla; Dr. Roscoe, F.R.S.; J. Baxendell; J. Barclay; F. O. Ward; J. A. R. Newlands; May and Baker (with enclosures); the Abbé Moigno; A. Herrmann and Co.; J. Foord (with enclosure); J. Landauer (with enclosure); A. T. Coimbro; W. A. Townsend and Adams; T. A. Readwin (with enclosure); E. F. Russell J. Smythe. (with enclosure); J. Clark; Olinthus Barry; G. Farrer Rodwell; J Davies (with enclosure); C. Stride; R. C. C. Lippincott; J. Sutherland; P. Clavel (with enclosure); Mottershead and Co. (with enclosure); Dr. S. Macadam (with enclosure); R. Gracsser (with enclosure).

SUPPLEMENT
TO THE
CHEMICAL NEWS.
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TECHNICAL EDUCATION.

The subject of Technical Education has recently attracted attention in this country, owing to the evidence considered to be afforded by the International Exhibition at Paris, of the inferior rate of progress recently made in manufacturing and mechanical industry in England compared with that made in other European countries. It has been stated that this alleged inferiority is due in a great measure to the want of technical education, and steps have, therefore, been taken to ascertain from many eminent English jurors whether they agree with this opinion.

We have been favoured with an early copy of the correspondence which has taken place on this subject, and we think we shall be doing good service to the cause of education by laying an abstract of some of the letters before the readers of the Chemical News. The inquiry originated in a letter from Dr. Lyon Playfair to Lord Taunton, Chairman of the Schools Inquiry Commission. In it he states that, with very few exceptions, a singular accordance of opinion prevails that our country has shown little inventiveness, and made but little progress in the peaceful arts of industry since 1862. When he found some of our chief mechanical and civil engineers lamenting the want of progress in their industries, and pointing to the wonderful advances which other nations are making; when he found our chemical, and even textile, manufacturers uttering similar complaints, he naturally devoted attention to elicit their views as to the causes. So far as could be gathered by conversation, the one cause upon which there was most unanimity of conviction was that France, Prussia, Austria, Belgium, and Switzerland possess good systems of industrial education for the masters and managers of factories and workshops, and that England possesses none. A second cause was also generally, though not so universally admitted, that we had suffered from the want of cordiality between the employers of labour and workmen, engendered by the numerous strikes, and more particularly by that rule of many trades' unions, that men shall work upon an average ability, without giving free scope to the skill and ability which they may individually possess. Dumas asserts that technical education had given a great impulse to the industry of France. In going through the Exhibition, whenever anything excellent in French manufacture struck his attention, his invariable question was, "Was the manager of this establishment a pupil of the *Ecole Centrale des Arts et Manufactures?*" and in the great majority of cases he received a reply in the affirmative. General Morin, so well known as the director of the *Conservatoire des Arts et Metiers*, has lately sat on a commission to examine into the state of technical education in other countries, and to extend it in France, and their recommendations are likely to be promptly and largely acted upon. General Morin was of opinion that the best system for the technical education of *workmen* is to be found in Austria, though the higher instruction of masters and managers is better illustrated in France, Prussia, and Switzerland.

In 1853 Dr. Playfair published a little work on "Industrial Education on the Continent," in which he pointed out that as an inevitable result of the attention given to it abroad, and its neglect in England, other nations must advance in industry at a much greater rate than our own country. It is feared that this result is already attained for many of our staple industries, and the writer concludes his eloquently written letter by urging upon the Government to hold an official inquiry on this subject, and tell the people of England authoritatively what are the means by which the great States are attaining an intellectual pre-eminence among the industrial classes, and how they are making this to bear on the rapid progress of their national industries.

This letter was considered so important that copies of it were sent to a great number of eminent English jurors, with a request that they would communicate their views on the subject.

We extract from the numerous answers the following opinions, which more particularly bear on chemical and physical education :—

Professor Tyndall, F.R.S., expresses a general concurrence in the views of Dr. Playfair. The facilities for scientific education are far greater on the Continent than in England, and where such differences exist, England is sure to fall behind as regards those industries into which the scientific element enters.

He has long entertained the opinion, that in virtue of the better education provided by continental nations, England must one day—and that no distant one—find herself outstripped by those nations, both in the arts of peace and war. As sure as knowledge is power this must be the result.

Dr. Frankland, F.R.S., says that Dr. Playfair's communication substantially expresses his own convictions in regard to the matters therein mentioned. As a juror in class 44 of the present Paris Exhibition, he was not only forcibly struck by the want of evidence of progress in the different branches of chemical manufactures carried on in Great Britain, but still more so at the great advances made by other nations, more especially by Germany, France, and Switzerland, in respect of such manufactures since the year 1862, when, as a juror in the corresponding class, he had also an opportunity of comparing the chemical manufactures of different nations. He refers this want of progress in the manufactures of this country chiefly to the almost utter lack of a good preparatory education for those destined to take part in industrial pursuits. This great defect in the school and college education of England affects the masters and managers of our factories even more deeply than the workmen themselves. The former have but rarely had any opportunities of making themselves acquainted with the fundamental laws and principles of physics and chemistry; they therefore find themselves engaged in pursuits for which their previous education has afforded them no preparation, and hence their inability to originate inventions and improvements. It is true that such men not unfrequently imagine themselves inventors, and the yearly files of patent specifications abound with instances of their so-called inventions. The great loss of time and money attending these futile patents would be rendered impossible by a very moderate, if accurate, knowledge of chemical and physical science.

In the polytechnic schools of Germany and Switzerland the future manufacturer or manager is made familiar with those laws and applications of the great natural forces which must always form the basis of every intelligent and progressive industry. It seems that at length this superiority in previous training is more than counterbalancing the undoubted advantages which this country possesses in raw material.

Dr. David S. Price considers that as far as relates to chemical products, the exhibition made by Great Britain is a "deficient representation," and will not enable foreigners to form a correct estimate of the nature and extent of chemical manufactures now carried on in this country; what is shown in class 44 is, as a rule, injudiciously exhibited, contrasting painfully with the taste and spirit evinced by the French in their arrangements in the same class.

The writer's conviction is that it is most important that these international competitions should not be allowed to degenerate into a means for advertising, and that it behoves those who are intrusted with their organisation

to see that the several departments of industry are intrusted to men who take an active interest in them, and are thus a guarantee that every endeavour will be made to have them fairly and properly represented, which is not the case on the present occasion, so far at least as refers to classes 40 and 44.

He does not agree with Dr. Playfair that the technical education of working men is the most important method for the maintenance of our industrial supremacy. The information gleaned by acting upon his suggestion would be instructive, and great good would result from its application; but what is really wanted for this country, and is of vital consequence to our future prosperity, is a higher scientific culture of those who are likely, in the natural course of events, to be master manufacturers, so that when discoveries are made they may fructify and not stagnate or decay, as has too often been the case, for want of intelligence on the part of those who command capital and works to perceive their merits; and that they, the manufacturers, may be able to appreciate and adequately remunerate the scientific talent that this country is, and always will be, able to afford them. No reformation bearing upon industrial progress is more required than in the Legislature, and it is a reproach to the country that science is not represented in Parliament.

It would be well if an investigation were made as to what have been the results of the teachings in science of the German universities; what Liebig has done for modern chemistry, and how the system inaugurated by him at the small University of Giessen has spread throughout the world, and what benefits have resulted from it; what we owe to the teachings of other chemists, the physicists, metallurgists, and geologists of those excellent seats of learning. Whilst advocating the necessity for the dissemination of scientific training in England, Dr. Price does not omit to bestow a passing tribute of commendation to the success of those institutions of recent date which were established to supply a want that existed many years since;—the Royal College of Chemistry, of which the late Prince Consort was the President, the School of Mines, and the colleges in the metropolis where scientific departments have been founded. In the first named, many of the men who have taught, and not a few of those who have studied there, have not only enriched chemical science by their researches, but have left a permanent mark upon the leading industries of this country. From the School of Mines have emanated men who in metallurgy and geology have greatly extended the application of those sciences. It is, however, a well-known fact that the public do not rightly appreciate the education that this institution is capable of affording, and that comparatively but few of the sons of manufacturers avail themselves of its advantages.

The writer calls particular attention to a plan proposed by the eminent chemist, Frémy, that young chemists of talent, who are desirous of devoting their time to the advancement of science, and therefore for the benefit of mankind, should be liberally supported by the State. It is suggested that this excellent idea should be brought to the notice of the Chancellor of the University of London, who from his well-known zeal in the cause of education, and from his position, is better able than any one else to obtain the evidence of scientific men as to its value, and, if approved of, to secure its adoption in this country. The same principle might well be extended to the other departments of science which bear upon industrial progress.

The author's firm belief is that extended scientific education is of the highest consequence to us if we wish to retain our present position in the scale of nations; that it will mostly benefit the future master manufacturer, that it must tend to elevate the social position of the intelligent working man, and to create a greater sympathy between master and man than at present prevails, and if it do this, the evils which threaten to impede, if not to paralyse our national progress, may be averted.

James Young, Chemical Works, Bathgate, feels bound to say that his experience accords with that of Dr. Lyon Playfair. So formidable did the rate of progress of other nations appear to many, that several meetings of jurors, exhibitors, and others took place at the Louvre Hotel on the subject. The universal impression at these meetings was that the rate of progress of foreign nations in the larger number of our staple industries was much greater than our own. But it must be stated that a large number of our first-class machine and other manufacturers are not exhibitors in Paris, whereas other nations, he believes, have taken care to bring forward their very best; still, the great progress of other countries is evident. The reason for this increased rate of progress is the excellent system of technical education given to the masters of workshops, sub-managers, foremen, and even workmen.

England for a long time excelled all other countries in the finish of her machines; but now we find that foreign machine makers are rapidly approaching us in finish, and, having skilled and intelligent labour cheaper than ourselves, are progressing in all the elements of manufacturing.

The writer uses his own case as an illustration. Originally he was a working man, but he has succeeded in increasing the range of manufacturing industry. The foundation of his success consisted in his having been fortunately attached to the laboratory of the Andersonian University in Glasgow, when he learned chemistry under Graham, and natural philosophy and other subjects under the respective professors. This knowledge gave him the power of improving the chemical manufactures into which he afterwards passed as a servant, and ultimately led to his being the founder of a new branch of industry, and owner of the largest chemical manufacturing works of the kingdom. It would be most ungrateful of him if he did not recognize the importance of scientific and technical education in improving and advancing manufactures. Many men without such education have made inventions and improvements, but they have struggled against enormous difficulties, which only a powerful genius could overcome, and they have been sensible of the obstacles to their progress. Stephenson, who so greatly improved locomotives, had to be his own instructor, but he sent his son Robert to Edinburgh University, and the son did works at least as great as the father, and with far less difficulty to himself.

The improvement in locomotion has necessarily created great competition in the industries of the world; and unless we add skilled instruction to manual labour, England cannot expect to maintain her position in the industrial race.

Red Lead, according to Barton, may be produced by heating oxide of lead to redness with nitrate of soda, or, by heating at the same temperature a mixture of 1,894 parts of sulphate of lead, 665 parts of carbonate of soda, and 177 parts of nitrate of soda. The resulting mass is to be washed.—*Berggeist*, No. 50.

The Queen's English at Paris.—The following is a literal copy of a handbill which has been extensively circulated in the Exhibition by a Spanish firm: "Blacking, ocly and resinous, titled the emperor of the blackings black ink and of allcolours to write with of D. J. G .... member of the national academy of Great Britain. This Blackings is knoconed to be the most useful for the conservation of the shes, for its brilliancy, solidity, and complete discomposition of the black animal. Mr. J. G. dus a present of £20 sterling to the person that will present hum a blacking in paste, that will reunite the same conditions, as the Emperor of the Blackings."

ON THE

UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

(Continued from page 56).

Aniline Reds,

called *fuchsine*, *roseine*, *azaleine*, *rosaniline*, *Magenta*, *Solferino*, and other fanciful names, are conspicuous in the American section of the Paris Exhibition of this year. This colour was obtained by Dr. Hofmann as far back as the year 1843, when he was experimenting on aniline with fuming nitric acid; and 15 years latter (in 1858) he again obtained it, when he was studying the reactions of bichloride of carbon on aniline. He found, indeed, that when 3 parts of aniline were heated with one part of bichloride of carbon for some time, a resinous mass was produced which furnished to alcohol a rich crimson colour. This was aniline red; but, as he was studying the reactions for other purposes than the formation of coloured products, he merely noticed the fact, and put it upon record. A year after Messrs, Verguin and Rénaud Brothers, of Lyons, discovered and patented their process for making *fuchsine*, or aniline red, from aniline, by means of bichloride of tin; and thus a practical value was given to the scientific researches of Dr. Hofmann. Fuchsine is obtained by heating together 10 parts of aniline and 6 of anhydrous bichloride of tin in a glazed iron vessel for 15 or 20 minutes. The temperature should be about that of the boiling-point of the mixture (392° Fahr.). At first the mixture becomes yellow, then gradually more and more red, until the liquid mass looks black. When this occurs it is allowed to cool, and the mass is treated with a large quantity of boiling water, which acquires a rich crimson colour. This is the dye, and it may be used at once, or purified by adding to it a quantity of common salt, in which solution the dye is insoluble. The precipitated colouring matter is allowed to subside, and, after being collected upon a filter, it is dissolved in spirit, or acetic acid, and so forms the red dye. The process patented by Mr. David Price, in the year following (1859), was to act upon a solution of sulphate of aniline with peroxide of lead, by boiling them together in the proportion of one equivalent of the former to two of the latter, until the solution acquires a deep red colour. This is filtered; and, after being concentrated by evaporation, it is again filtered, to separate a resinous substance which forms in it. An alkali is then added to neutralize the acid, and the colouring matter is precipitated as a dirty brown powder. When this is collected upon a filter, washed with water, and dissolved in spirit or acetic acid, it forms a beautiful red dye, which is fit for use. Messrs. Simpson, Maule, and Nicholson, used this process very largely until the beginning of the year 1860, when Dr. Medlock committed to them his patent for making aniline red by means of arsenic acid. The process now followed is to mix together a highly concentrated solution of arsenic acid with aniline, using the latter a little in excess; a good proportion is 20 parts by weight of syrupy arsenic acid, containing 76 per cent of the solid acid, and 12 of commercial aniline. In this manner a pasty mass of arseniate of aniline is formed, and, when this is heated for some time at a temperature of about 300° Fahr., it intumesces, and at last forms a dark-coloured liquid, which, on cooling, sets into a resinous solid, with a bronze-like lustre. The crude colouring matter thus obtained is very soluble in spirit or water, and may be at once used for dyeing purposes, but it is better to purify it by adding a slight excess of slaked lime to the aqueous solution, and so precipitating the colouring matter with the insoluble arsenical salts of lime. The mixed precipitates are collected upon a filter, and the colouring matter dissolved out with acetic or tartaric acid. Another and better method of purification is to dissolve the crude mass in dilute muriatic acid; then to filter, and to precipitate by adding a slight excess of alkali (carbonate of soda). The colour thus set free is to be collected upon a filter, washed with water, and then dissolved in spirit and acetic acid.

Another variety of aniline red, the nitrate of rosaniline, or *azaleine*, has been extensively manufactured in England by the process of Mr. Perkin, and in France by that of M. Gerber Keller. Mr. Perkin heats a mixture of aniline, or its homologues, with dry pernitrate of mercury for some time, at a temperature of 347° Fahr. The mixture first becomes brown, and then gradually acquires a dark crimson colour, during which time the mercury is reduced, and settles to the bottom of the fused mixture. On pouring it off, and allowing it to cool, it forms a solid mass of impure nitrate of rosaniline, which may be purified by dissolving in water, and precipitating with common salt. M. Gerber Keller's process is nearly similar, except that he uses a lower temperature. He takes 10 parts of aniline, and 7 or 8 parts of dry pernitrate of mercury, and heats the mixture for several hours in a bath of boiling water. Messrs. Dale and Caro obtain the colour by heating a mixture of equal parts of aniline and powdered nitrate of lead, and then adding little by little a fourth part of anhydrous phosphoric acid. Other processes have also been patented, as that of Lauth and Depoully (1860), with nitric acid; that of Smith (1860), with perchloride of antimony, antimonic acid, peroxide of bismuth, stannic, ferric, mercuric, and cupric oxides; and Gerber Keller has claimed almost every common metallic salt that is known. As might be expected, a number of these processes are practically useless, and have been claimed for no other purpose than that of anticipating the profits of future discoveries.

Aniline Blues,

called *azaline*, *Bleu de Paris*, *Bleu de Lyons*, *Bleu de Mulhouse*, &c. Soon after the discovery of aniline red, it was observed that certain reducing agents had the property when heated with it of changing its colour to a purple or blue. Mr. Charles Lauth, for example, in 1860, described the blue colour which was obtained from *azaleine* (nitrate of rosaniline) by means of protochloride of tin, aldehyde, the natural essences, &c.; and M. Kopp demonstrated that the same colour was produced from aniline red by means of wood spirit. But as none of these colours were permanent, they were disregarded. In 1861 MM. Girard and De Laire procured their imperial purple in the manner already mentioned, by heating equal weights of aniline and dry muriate of rosaniline, at a temperature of about 350° Fahr., for several hours. If the purple is wanted, the mass is merely treated with dilute muriatic acid until it loses its excess of aniline and aniline red, but if a pure blue is required, the acid treatment is continued until all the red tint is removed, and a pure blue remains. This is finally dissolved in acetic acid, or methylated spirit, and the blue dye, called *Bleu de Lyons*, is obtained. The same blue, but called *Bleu de Paris*, was procured by MM. Persoz, De Luynes, and Salvetat, by heating a mixture of aniline and dry bichloride of mercury in a sealed tube fo 30 hours, at a temperature of 356° Fahr. The mass when cold is dissolved in boiling water, and the colour precipitated by means of common salt. This operation is repeated until the blue is quite free from the green pigment which accompanies it.

A blue, called *Bleu de Mulhouse*, may be obtained by the process patented by MM. Gros-Renaud and Schœffer in 1861, and which consists in boiling a solution of *azaleine* (nitrate of rosaniline) with gum lac and carbonate of soda for some time; and another blue, named *azuline*, has been produced by M. Marnas by a like treatment of a substance called *peonine*, with eight times its weight of aniline; and the residuum is purified with a succession of solvents, as water acidulated with muriatic or sulphuric acid, then

hot naphtha, then caustic alkali, and finally with water acidulated with muriatic acid. The azuline, or blue colour, which remains, is soluble in spirit and forms a rich blue dye. Blues are also produced by the action of numerous oxidizing agents on aniline or its salts, as by a solution of hypochlorous acid (Hofmann), by a solution of chlorate of potash and muriatic acid (Fritzsche), by peroxide of hydrogen (Lauth), by perchloride of iron or red prussiate of potash (Kopp), by peroxide of manganese or pernitrate of iron and hydrochloric acid (Scheurer-Kestner), by bichromate of potash and acid (Willm), and I have obtained it by oxidising the sulphate of aniline by means of the oxygen disengaged at the positive pole of a battery. In all these cases the blue is very difficult of solution, for it resists the action of every solvent but strong sulphuric acid. Taking advantage of this, Mr. Nicholson, in 1862, patented a process for purifying the blue colouring matter, by dissolving it in concentrated sulphuric acid, and then heating it for half an hour at a temperature of 302° Fahr. By diluting it with water it is precipitated in a modified condition, for it is now soluble in pure water. Dr. Hofmann ascertained that it was a substitution compound of rosaniline, in which three equivalents of hydrogen had been substituted by three equivalents of a hydrocarbon called phenyl ($C_{12}H_5$); he therefore named it tryphenylic-rosaniline, and this suggested the possibility of substituting other hydrocarbons, as methyl (C_2H_3), ethyl (C_4H_5), amyl ($C_{10}H_{11}$), &c., in which he was successful by acting upon rosaniline with the iodides of these radicals, and thus producing ethylic, methylic, and amylic substitution compounds of a rich blue and purple colour, called Hofmann's blues. Very recently the change has been effected by a more direct process without the aid of the iodide, but by heating a mixture of aniline, muriatic acid, and methylic alcohol under pressure, and then treating with iodine and chlorate of potash, or other oxidizing agent.

Aniline Greens.

Most of the blue substances just described become green by the action of acids, and again acquire a blue colour when they are washed or treated with alkalies. It has also been noticed that in certain states of oxidation, aniline acquires a green tint; but all attempts to utilize this colour failed until, in 1860, Messrs. Calvert, Clift, and Lowe patented the process for producing it upon the fabric. Their process was to prepare the fabric with chlorate of potash, and then to print upon it with acid muriate of aniline. In a few hours a beautiful bright green colour, called *emeraldine*, gradually appeared, and it was fixed by merely washing it with water. If a blue tint were required, the fabric was passed through a solution of bichromate of potash, when the oxidation of the aniline was carried still further, and a dark indigo blue, called *azurine*, was produced.

A green colour may also be obtained by heating a mixture of two parts fuchsine with three parts strong sulphuric acid and one part water. When the solution of the fuchsine is complete it is allowed to cool, and four parts of aldehyde are added. The mixture is again heated until it is a bright blue colour without a trace of violet. It is then treated with a boiling solution of hyposulphite of soda, and filtered. The residue upon the filter is to be boiled in water, and filtered while hot. After standing 24 hours it deposits a green precipitate.

Aniline Black.

Several processes have been proposed for making a black dye from aniline, as by acting on aniline with an oxide of chlorine, and then with a salt of copper; but the colour is not of sufficient importance to command attention.

Aniline Yellow,

callled *chrysaniline*, or *phosphine*. This colour was first obtained by Mr. Nicholson, in 1861. He procured it from the residuum of rosaniline by the action of steam, whereby a dirty yellow solution was obtained. On adding nitric acid to the solution, the yellow dye was thrown down as a nitrate of little solubility, and by decomposing it with an alkali the base is set free, which either alone or in a form of a soluble salt communicates a rich yellow colour to silk and wool.

These are the principal colours obtained from aniline, and it may be of interest to examine the leading properties of these remarkable compounds. At first you will have remarked that the bases of nearly all the aniline colours are very insoluble in water, ether, and coal naphtha. They are more soluble in water acidulated with the mineral acids, and are still more soluble in acetic acid. Alcohol, however, is the great solvent for them. You will likewise observe that they are generally precipitated from their saline solutions by alkalies and by common salt, and in this manner they are generally purified. Tannin also produces an insoluble compound with them, and thus they are often fixed upon vegetable fabrics. They are endowed with great power of resistance, for they will bear the action of strong sulphuric acid without undergoing decomposition, but they cannot resist the action of powerful oxidizing agents, as chlorine, chloride of lime, or nitric acid. Reducing agents, as sulphide of ammonium and protosulphate of iron, destroy their colour; but the action is not permanent, for on exposure to the air oxygen is absorbed, and the colour reappears.

The bases themselves are not generally coloured, but they acquire their characteristic tints when they combine with acids. I have here the colourless, or nearly colourless, solutions of rosaniline, mauvine, and aniline blue, and you will remark that directly I expose them to the vapours of an acid (acetic) their characteristic tints appear.

The tinctorial power of these dyes is remarkably great. If, for example, I put a little Magenta, mauve, or aniline blue upon paper, and then shake off the powder as completely as possible, there yet remains sufficient to give deep tints when I blow a fine spray of alcohol and acetic acid upon the paper.

The affinity of animal substances, as silk, wool, feathers, horn, ivory, leather, &c., is so great that the dye instantly combines with them, and produces a permanent stain. The affinity, indeed, is so great that, as you will here see, a piece of flannel will completely absorb and remove the colouring matter from its solution in water. Vegetable tissues, however, have no such affinity for the colour, and therefore processes must be adopted for fixing the dye upon cotton and linen fabrics. One of these processes is to prepare the fabric with some animal substance, as albumen, serum of blood, the caseine of milk, or the gluten of wheaten flour. Advantage is also taken of the power which tannin has of combining with the colour and and rendering it insoluble. The process of Messrs. Puller and Perkin is to soak the cotton tissue in a decoction of shumach, or other tannin material, for an hour or two, and then in a solution of stannate of soda for another hour; after which it is dipped into dilute sulphuric acid, and is then ready for the dye. By these contrivances the aniline colours are made fast upon all kinds of vegetable fabrics.

Starch appears to have the power of fixing the colours, for if shaken with weak solutions of them it will absorb the colour, and by falling to the bottom of the liquid leave the solution colourless.

Poisoning by Chlorine Vapour.—Professor Maisch says that a direct antidote to the poisonous effects of the inhalation of chlorine is sulphuretted hydrogen, the halogen combining instantly with the hydrogen, liberating sulphur. The professor has tried it himself after accidentally inhaling chlorine, and obtained immediate relief. The same remedy would doubtless be effectual in cases of bromine poisoning.

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THE CHEMICAL NEWS.

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ON THE PRACTICAL LOSSES OF SULPHUR, &c., IN THE VITRIOL MANUFACTURE.

By CHARLES R. A. WRIGHT, B.Sc.

The main causes of the great differences often visible between the amount of sulphuric acid theoretically obtainable from a given quantity of sulphur, and that practically obtained, seem to be three in number, viz.:—

(1). Loss of SO_2 by leakage from burners, pipes, chambers, &c.

(2). Incomplete combustion of all the sulphur used.

(3). Non-conversion of all SO_2 formed into SO_4H_2 and consequent loss of SO_2 by its passage as such into the chimney.

(I). The prevention of the first source of loss is a mere mechanical matter; without great care on the part of the workman a considerable amount of sulphurous gas may escape from the kilns during the process of recharging, &c.; inattention to the speedy repair of all leaks in brickwork, pipes, tunnels, &c., may also cause a considerable amount of loss.

Notwithstanding the manifest bad policy of such a course, it is not uncommon to find a manufacturer neglecting to stop a chamber for repairs until the escape of gases by leakage has almost completely corroded the wooden framework of the chamber. The writer has seen a chamber, when stopped at last, present, to an observer inside, the appearance of a star-spangled sky, owing to the large number of small holes and leaks; in such an instance as this, the loss of time in stopping earlier for repairs and the expense, would have been many times repaid by the saving of sulphur lost by leakage, not to speak of the prevention of damage to the framework of the chamber and to surrounding objects by corrosion. Not only is sulphur thus lost by leakage and diffusion, but excess of air is often drawn into the chamber through the holes, thus practically diminishing the size of the chamber, and still further reducing the yield. It may be noticed here that want of attention on the part of the plumbers in first building the chamber, in so attaching the strap as to distribute the weight of the lead equally, is a frequent cause of small holes and leaks; the leaden sheet is apt to become torn where the strap is attached if too great a strain be upon it, and even if not torn the lead is strained, becomes thinner, and is more readily perforated by the action of the contained gases. The quality of the lead used, too, is of great importance; it is a false economy to buy cheap sheet lead, as it is almost certain to wear unequally, and last a much shorter time than a really good well manufactured article.

Some manufacturers consider it more profitable, in the long run, to pull down a chamber after working four, five, or six years, to melt up the lead, and rebuild with fresh materials, giving extensive repairs to the foundations, framework, kilns, &c., wherever necessary; calculating that the loss of time and capital in thus rebuilding is no more than what would have been necessary for repairs alone had the chamber been kept at work a few years longer; whilst the prevention of damage by leakage and the saving of sulphur render a handsome return for the outlay; others, again, prefer to work a chamber for eight, nine, ten years almost uninterruptedly; in fact for as long as it can by any artifice be made to hold gases.

The following numbers, being the results of successive years' working with a series of chambers to which but little repairs were allowed during the whole time, illustrate the enhanced loss from the increasing leakage:—

	Nitre used per 100 parts of sulphur burnt.	Cubic mètres of chamber space per kilogramme of sulphur burnt per diem.	Practical yield Theoretical = 100.
1st year ..	9·31 ..	1·150 ..	81·5
2nd ,, ..	9·84 ..	1·073 ..	75·4
3rd ,, ..	10·02 ..	1·017 ..	68·4

It is here manifest that while the sulphur burnt has increased a little, there is a very great falling off in the yield, notwithstanding that the proportion of nitre used is progressively greater; the total amounts lost in the three periods are respectively 18·5, 24·6, and 31·6.

(II.) The loss of sulphur from incomplete combustion in the burners is only noticeable to any great extent where pyrites is used. It is almost impossible to burn on the large scale any pyrites so that the burnt residue shall not contain at least 2·5 to 3·0 per cent of sulphur; where slaty pyrites containing about 30—35 per cent of sulphur (such as Wicklow sulphur ore) is used, the residue will probably retain 3·5 to 4·0 as a minimum,* and as this burnt pyrites amounts in weight to about 80 per cent of the green pyrites used, about 8 to 10 parts out of 100 of original sulphur will remain unburnt as a minimum.

When richer ores (such as Huelva) containing 48—50 per cent of sulphur are employed, the residue may contain 3 per cent of sulphur when fairly burnt, and will amount to about 67 per cent of the weight of green ore used; so that about four parts in the hundred of original sulphur remain unburnt. Sulphur may also be volatilized as such, condensing in the pipes, or being carried over into the chambers: this probably is entirely preventable by paying due attention to the temperature of the kilns, supply of air, &c.

(III.) The loss of sulphur from incomplete conversion of SO_2 into SO_4H_2 may be due to several minor causes, such as the introduction of too little steam, or too much air; the use of an insufficient quantity of nitre; or what is perhaps, most frequently the case, the allowance of too little chamber space in proportion to the amount of sulphur burnt.

Each manufacturer has a different standard as to the proportion of nitre which should be allowed to a given amount of sulphur; more nitre is required when pyrites is used than where sulphur is burnt, to overcome the dilution of the gases by the nitrogen of the air used to oxidise the iron, &c., contained in the pyrites; more nitre is again required when more sulphur is consumed to a given amount of chamber space. (*Vide* numbers previously given). The following numbers indicate the average amounts of nitre used by different manufacturers, who have kindly furnished the writer with information on this point:—

Material burnt.	Nitre per 100 parts of sulphur consumed.
Pyrites containing 45—50 per cent of sulphur	8·5
,, ,, 30—50 ,, ,,	12·0
,, ,, ditto ,, ,,	10·0
,, averaging 35 ,, ,,	12·5
Sulphur	10·0

N.B. In none of these instances were Gay Lussac's nitre towers employed. For comparison, the following numbers are quoted from Richardson and Watts's *Technological Dictionary*, Vol. 1, Part iii, second edition:—

		Nitre per 100 parts of sulphur used.
Page 71	Sulphur	5·0
317	ditto (Payen, Marseilles)	6·0
318	ditto (Jarrow Chemical Co.)	8·9
317	Irish pyrites (assumed to contain 30 per cent of sulphur, Gossage)	13·3

* With a hard slaty ore, 4 per cent of sulphur is probably below the mark for an average on the large scale; the writer has repeatedly seen heaps of hundreds of tons of such ore, carefully burnt, and yet retaining an average of 5 or 6 per cent of sulphur.

Again, each manufacturer has a different opinion as to the proportion to be observed between the chamber space and the amount of sulphur burnt. Thus the numbers given as an average in R. and W.'s *T. D.*, p. 80, correspond to 1·672 cubic mètre per kilogramme of sulphur burnt daily; in "Muspratt's Dictionary," *Art. Sulphuric Acid*, the numbers given as in use in a Lancashire works represent about 1·35 cubic mètre per kilogramme, whilst the numbers given before show that less space than this is often allowed. With reference to this point, it may be observed that, as a general rule, it is more profitable to sacrifice a small portion of the theoretical yield (*i.e.*, to cause the amount lost to be greater) in order to produce a greater quantity of a manufactured article, than it is to lessen the amount produced in order to gain the maximum yield possible. Some manufacturers indeed say it is better to strain everything to the utmost, to produce the maximum *quantity*; of course, however, there is a limit beyond which it is unwise to go, as the increased wear and tear and damage to *quality*, together with the diminished yield, may render this course the least paying.

It is difficult to give more than a rough estimate of the amount of loss which is practically wholly unavoidable. With Huelva pyrites, the results obtained with a large series of chambers furnished with coke towers, but not with Gay Lussac's denitrating apparatus, showed that it is perfectly possible to obtain 82—84 parts of sulphur in the form of acid of specific gravity 1·700 from 100 parts of sulphur used as pyrites; the nitre used being about 10 parts for every 100 of sulphur used; and from 1·100 to 1·200 cubic mètre of chamber space being allowed to every kilogramme of sulphur burnt daily. Of the 16—18 per cent of this *total loss* from 4 to 5 per cent were due to the sulphur left unburnt in the pyrites, and consequently about 12—13 per cent to other causes—viz., leakage, non-conversion of SO_2 into SO_4H_2 &c., &c.

"A Practical Chemist" writes to the Chemical News of July 13, 1866, that he obtains from a ton of Irish ore, at 30 per cent of sulphur from 18 cwt. 1 qr. 5lbs., to 18 cwt. 2qr. olb. of acid of specific gravity 1·75. Acid of this strength at 15°C contains 81·45 per cent of SO_4H_2 (Bineau). Hence his total loss is from 18·0 to 18·9 parts out of 100 of original sulphur, of which probably eight or nine parts are due to the unburnt sulphur in the pyrites.

Payen obtained from 1,600 kilogrammes of pure sulphur 4,280 of acid of specific gravity 1·85 (*i.e.*, of SO_4H_2). [Richardson and Watts's *Technological Dictionary*, I. iii. 317]. Hence his total loss was 12·7 parts in 100.

It would appear, therefore, that whether pure sulphur, rich pyrites containing 48—50 per cent. of sulphur, or poor pyrites at about 30 per cent are employed, from 10 to 13 parts of sulphur out of 100 employed are lost by causes other than the non-conversion into SO_2 of all the sulphur used. This probably represents about the minimum practical loss on the large scale; as noticed before, by bad repair of chambers, &c., &c., this loss is greatly enhanced.

ON THE ANALYSIS OF CAST IRON.

By EDMUND G. TOSH, Ph.D.

(Continued from page 67.)

c. *Wöhler's Chlorine Process.* This most excellent process is carried out in the following way. A weighed quantity of iron contained in a porcelain boat, is placed in a hard glass tube, and exposed at a dull red heat, to the action of chlorine (first dried by passing over pumice stone saturated with sulphuric acid) till no more perchloride of iron is formed. The whole of the carbon remains in the boat, which, when cool, is transferred into a porcelain tube, and the carbon burned in oxygen as before described. An estimation by this method may be performed in two hours. Care must be taken to have the chlorine perfectly free from moisture, otherwise a portion of carbon may be lost by the formation of hydrocarbons. The results given by this process are very concordant, as the three experiments given beneath show.

1. 1.001 grms. of metal in borings gave 0.1595 grm. of carbonic acid = 4.348 per cent of carbon.
2. 1.06775 grms. of metal gave 0.171 grm. CO_2 = 4.357 per cent carbon
3. 1.002 grms. of metal gave 0.159 grm. CO_2 = 4.327 per cent carbon.

According to Max Buchner*, this process affords results as accurate as those obtained by Berzelius' chloride of copper method; and Professor Kerl of Clausthal states that in his laboratory it is employed almost exclusively.

d. Weyl's Galvanic Method.†—This very ingenious and beautiful method for the estimation of carbon is founded upon the fact, that a piece of iron, attached to the positive pole of a galvanic battery, and suspended in hydrochloric acid, is dissolved, while the hydrogen is given off at the negative pole, dipping into the solution. Carbon and hydrogen do not thus come in contact in the nascent condition, and the formation of hydrocarbons, and a consequent loss, is prevented. A recommendation of this method is that the iron does not require to be in powder.

A piece of iron 2 to 4 grammes in weight, attached to the positive pole of a Bunsen's cell, is suspended in dilute hydrochloric acid, just below the surface of the liquid. From the negative pole hydrogen passes off, while the iron dissolves quite quietly, and the strong solution of protochloride of iron formed may be seen falling in a regular stream through the lighter liquid. The iron is dissolved in about 24 hours, and the carbon is left behind in the same shape as the piece of metal from which it was derived.

In Weyl's earlier experiments it was found that some of the liberated carbon at the positive pole was carried over to the negative pole by the mechanical working of the stream. To prevent this, a diaphragm of bladder or parchment paper is interposed between the two, which entirely obviates the possibility of loss in this way.‡

Weyl recommends that the piece of iron should be suspended by means of platina pointed forceps, in such a manner that the acid does not reach the iron at its point of contact with the forceps, otherwise after the partial solution of the iron, the separated carbon intervening between the forcep points and the remaining piece of metal, would interrupt the galvanic current and the experiment would be lost. In my researches I used a small platinum sieve, kindly lent me by Professor Wöhler, in which I laid the pieces of iron, wholly immersed in the acid, and the action proceeded till the end as well as it did at the commencement. This interruption of the current is not, I think, to be feared, as both amorphous carbon and graphite are good conductors of electricity.

Schnitzler§ when examining this process always found that a small quantity of hydrogen was given off from the piece of iron during solution, and attributed this to the action of acid on small particles of metal which were unconnected with the main piece, distributed through the surrounding carbon, and beyond the influence of the galvanic stream. If we look upon carbon as a conductor of electricity this theory does not hold good. I noticed this evolution of gas in all my experiments, however dilute the acid. Immediately on dipping the piece of iron into the acid, gas bubbles formed on its surface, showing that the action had commenced, which, for my own part, I am inclined to attribute to a secondary and independent galvanic action between the iron and free carbon, either previously existing throughout the metal, or liberated the moment solution begins.

* *Berg- u. Huttm-Zeitung. Jahrg.* 24. No. 10. p. 84
† *Pogg. Ann.* Bd. iii. p. 507.
‡ *Pogg. Ann.* bd. 120. p. 617.
§ *Zeit. Anal. Chem.* b. iv. p. 78.

This evolved hydrogen possesses the characteristic odour due to the presence of hydrocarbons, always noticeable when cast iron is dissolved in acids under ordinary circumstances. As shown by Schnitzler, a loss of carbon consequently ensues, and my estimations lead to the same conclusion.

When no more hydrogen is given off at the negative electrode, showing that all the iron is dissolved, the carbon is collected in a small funnel stopped with asbestos, dried cautiously, transferred to a platinum boat, and burned in a stream of oxygen, and the resulting carbonic acid is absorbed in the ordinary way by potash solution. Subjoined are the results of two experiments:—

1. A piece of iron weighing 3·59125 grms. gave 0·5575 grm. CO_2=4.235 per cent of carbon.
2. 2·04075 grms. of iron gave 0·30575 grm. CO_2=4·086 per cent of carbon.

Weyl† has also proposed a second method for the solution of iron without the evolution of hydrogen, which consists in suspending a piece of the metal in dilute sulphuric acid, containing bichromate of potash dissolved. The carbon is unaffected, and when most of the iron is removed, the residue may be collected and burned in oxygen. I have made no estimation by this means.

Of these various methods I selected that of Wöhler for the determination of carbon in the specimens of iron I have examined, because while recording results of equal reliability with any, its performance requires much less time.

Arranged below in a tubular form are the amounts of carbon per cent, indicated by the various methods, in the same sample of iron.

	Carbon. Per cent.
1. Regnault's combustion process ..	3·886
2. ,, ,, ,, ..	3·996
3. Fresenius' method	4·244
4. ,, ,, ...	4·166
5. Wöhler's chlorine process	4·348
6. ,, ,, ,, ...	4·367
7. ,, ,, ,, ...	4·327
8. Weyl's galvanic method	4·235
9. ,, ,, ,, ...	4·086

ON THE

UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

(Continued from page 92).

The rationale of the change which takes place during the formation of the several colours is not altogether clear, although there can be no doubt that the essential part of it is the oxidation of aniline; for, as I have already stated, when a salt of aniline is exposed to the action of nascent oxygen set free from the positive pole of a galvanic battery, the characteristic tints of aniline are successively and quickly produced. At first there is bright yellow, then green, blue, violet, and lastly red, as if these were the successive phases of oxidation. The researches of Dr. Hofmann have demonstrated that all the aniline reds are salts of a well defined base, which he has named *rosaniline*; and the more recent inquiries of MM. de Laire, Girard, and Chapoteaut have shown that there are four such bases entering into the composition of coal-tar colours, as *violaniline*, *mauvaniline*, *rosaniline*, and *chrysotoluidine*, which form an arithmetical series advancing by successive additions of C_2H_2, thus:—

* *Pog. Ann.* bd. cxxvi. p. 617.

Violaniline	$C_{36}H_{15}N_3$
Mauvaniline	$C_{38}H_{17}N_3$
Rosaniline	$C_{40}H_{19}N_3$
Chrysotoluidine	$C_{42}H_{21}N_3$

Each of these bodies is produced in the same manner, by the oxidation and removal of 6 atoms of hydrogen from 3 atoms of aniline, or 3 atoms of toluidine, or 3 atoms of the mixed bases, thus:—

6 atoms of hydrogen from 3 atoms of aniline produce *violaniline*.

$$\underbrace{3(C_{12}H_7N)}_{\text{Aniline.}} - H_6 = \underbrace{C_{36}H_{15}N_3}_{\text{Violaniline.}}$$

6 atoms of hydrogen from 2 atoms of aniline and 1 of toluidine produce *mauvaniline*.

$$\underbrace{2(C_{12}H_7N)}_{\text{Aniline.}} + \underbrace{C_{14}H_9N}_{\text{Toluidine.}} - H_6 = \underbrace{C_{38}H_{17}N_3}_{\text{Mauvaniline.}}$$

6 atoms of hydrogen from 1 atom of aniline and 2 of toluidine produce *rosaniline*.

$$\underbrace{C_{12}H_7N}_{\text{Aniline.}} + 2\underbrace{(C_{14}H_9N)}_{\text{Toluidine.}} - H_6 = \underbrace{C_{40}H_{19}N_3}_{\text{Rosaniline.}}$$

and 6 atoms of hydrogen from 3 atoms of toluidine produce *chrysotoluidine*.

$$\underbrace{3(C_{14}H_9N)}_{\text{Toluidine.}} - H_6 = \underbrace{C_{42}H_{21}N_3}_{\text{Chrysotoluidine.}}$$

These colour bases are perfectly homologous in all respects, for they not only unite with acids to form salts which crystallise very freely, and which have remarkable tinctorial power, but they also contain within them three atoms of typic hydrogen, which may be replaced by certain radicals, as of the alcohols, &c.—methyl, ethyl, phenyl, &c.—forming derivative compounds of like basic properties, and frequently of high tinctorial quality.

The best known of these bases is *rosaniline*, which in its anhydrous condition is represented by the formula

$$C_{40}H_{19}N_3,$$

but which always contains two atoms of water in the hydrated state in which it is set free from its compounds, thus:—

$$C_{40}H_{19}N_3,2HO$$

It is readily obtained by decomposing its salts—the aniline reds—with an excess of alkali, soda, or ammonia, and in this state it falls as a dirty yellow or brownish-yellow precipitate; but by careful purification it occurs as a colourless base, which quickly becomes rose-red on exposure to any acid, even the carbonic acid of the atmosphere. It is nearly insoluble in water, slightly so in ammonia, and very soluble in alcohol, forming a deep red solution. Ether and coal-tar naphtha have no solvent action upon it. It combines with one, two, or three equivalents of acid to form salts which crystallize very readily, the first of them, the mono-acid salts, being remarkable for their lustrous metallic or bronze-like appearance and their beautiful rose-red solutions; these, indeed, are the true colouring compounds, the most important of which are the following:—

Fuchsine, or muriate of rosaniline ..	$C_{40}H_{19}N_3,HCl$
Azaleine or *Magenta*, the nitrate ..	$C_{40}H_{19}N_3,HNO_6$
Roseine, the acetate	$C_{40}H_{19}N_3,HC_4H_3O_4$

It was the last-named salt which composed the splendid bronze-like crystals of the crowns which were exhibited in 1862 by Mr. Nicholson. And, besides these, there are sulphate, arseniate, oxalate, chromate, tannate, &c., of rosaniline. Most of them are freely soluble in water and in spirit, but the tannate is so insoluble in water that it is used for fixing the colour upon calico, and for recovering the dye from very weak solutions. To this end the otherwise waste products of aniline red are treated with a fresh infusion of nut-galls, and in a short time the rosaniline is precipitated in the form of a magnificent red lake of tannate of rosaniline, leaving the solution quite colourless. This lake is soluble in spirit and in acetic acid, and may be thus used for dyeing.

The salts of rosaniline with two equivalents of acid have not been studied, and even those with three of acid are not of any technical value.

Under the influence of reducing agents, as sulphide of ammonium, or the nascent hydrogen evolved from zinc when a solution of rosaniline in muriatic acid is left in contact with the metal, it is rapidly decolorized, and is transformed into a new base, which Dr. Hofmann has named *leucaniline*. This is effected by the absorption of two atoms of hydrogen, thus :—

$$\underbrace{C_{40}H_{19}N_3}_{\text{Rosaniline.}} + 2H = \underbrace{C_{40}H_{21}N_3}_{\text{Leucaniline.}}$$

The new base occurs in the form of colourless acicular crystals, which are scarcely at all soluble in water, but freely so in alcohol. The salts of it are also colourless, or dazzling white, although they reacquire the red tint of rosaniline when their solutions are exposed to the action of oxidizing agents or even to the air.

Dr. Hofmann has ascertained that there is still another base derivable from, or closely related to, rosaniline—viz., *chrysaniline*. It is procured from the residual, or waste product of rosaniline, by the action of steam and nitric acid, as I have already described. It contains two atoms less of hydrogen than rosaniline, and therefore it stands in its relation to this base as rosaniline does to leucaniline, thus :—

Chrysaniline	$C_{40}H_{17}N_3$
Rosaniline	$C_{40}H_{19}N_3$
Leucaniline	$C_{40}H_{21}N_3$

It is very soluble in water, and it forms yellow salts with acids, one of which, the nitrate, is a very soluble compound. The solutions of the base and of its salts communicate a splendid golden yellow colour to animal tissues.

Aniline blues are, for the most part, substitution compounds of aniline red, the three atoms of typic hydrogen being replaced by three of an organic radical. The blue, for example, which is produced by the action of aniline on a salt of rosaniline, is a compound in which the three atoms of hydrogen are replaced by three of phenyl, thus :—

Aniline red, or *Rosaniline* .. .. $C_{40}H_{19}N_3$

Aniline blue, Triphenylic rosaniline $C_{40}\left\{\begin{matrix} H_{16} \\ (C_{12}H_5)_3 \end{matrix}\right\}N_3$

And its production when aniline is heated with a salt of rosaniline is accompanied with the evolution of ammonia, disregarding the acid of the compound, thus :—

$$C_{40}H_{19}N_3 + 3C_{12}H_7N = C_{40}\left\{\begin{matrix} H_{16} \\ (C_{12}H_5)_3 \end{matrix}\right\}N_3 + 3NH_3$$

Other substitution compounds, in which the three atoms of hydrogen are replaced by three of methyl, ethyl, amyl, &c., have been produced by Dr. Hofmann by the action of the iodides of these radicals on the salts of rosaniline, or even by the more simple and direct process of heating them with the alcohols of the radicals under pressure. All these compounds are basic in their character, and they mostly form, with one equivalent of an acid, the blue colours which are known as Hofmann's blue and violet, and the violet of Paris.

The other bases of aniline and toluidine colours have not been so well studied, but it is very probable that the reactions and the general properties of *violaniline*, *mauvaniline*, and *chrysotoluidine*, are very similar to the preceding, and that they are capable of forming the like reduction and substitution bases.

Anti-incrustation Mixture for the prevention of the formation of sediments (strongly adhesive) in steam boilers. 125 kilos. of crystallised chloride of barium dissolved in 50 kilos. of water with addition of 25 kilos. of hydrochloric acid (specific gravity 1·20). To every 1000 litres = 1 cubic mètre = 35·5 cubic feet English, 15 litres of this acid solution should be applied.—*Elsner's Chemisch. Technisch Notizen.* 1867.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

It is becoming common now to hear people express the wish that the present Exhibition will be the last for many years to come. But, as is so often the case in other matters, the majority of the persons who talk thus have really no definite reason for what they say. When you ask them for a motive for expressing their objection to exhibitions, you generally get such vague and unsubstantial reasons as "Oh, they are such a bore, you know." "They don't really do any good," or "They injure the retail trade of the cities where they are held." "One is sick of exhibitions," and so on. Now, while your correspondent has never once heard a really sound argument against exhibitions, he has, on repeated occasions, seen and heard enough to show him that the present Paris Exhibition must (if we do not allow our insular vanity to cause us to fall into decadence) exercise a most important influence upon our arts and manufactures.

I contend that no Englishman of sound judgment could possibly examine in detail, as your correspondent has done, the various departments allotted to the European kingdoms, without having the fact forced upon him that our neighbours are running abreast of us in a race which, if we lose, will disgrace us for ever.

The intense dislike which a vast number of influential people took to all the schemes of the late Prince Consort, led them to oppose everything connected with his attempts to encourage technical education. But, if we are to retain our supremacy—nay, if we are not to be ignominiously beaten in the very departments where we have somewhat too superciliously fancied ourselves invincible, we must not only soundly educate our workmen in all the subjects relating to their special avocations, but we must also *stimulate their ambition*.

Fortunately the minds of some of the most active and far-seeing of our scientific and political men are directed to this deeply important question, and your correspondent trusts that you, Mr. Editor, will keep the matter before the scientific public.

To chemists the matter is as important as to engineers and artists. The chemical manufactories of France and Germany, especially the latter, are always able to obtain the services of men who, having received their chemical education in laboratories directed by high-class men, are able to devise new processes, improve those already existing, and, especially, to adopt, simplify, and cheapen methods invented in this country, so as to deluge our markets with low-priced and often good articles, to the serious injury and even ruin of our own manufacturers.

Of all the faults which tend to the perpetuation of the system, or rather want of system, under which we are now obstinately insisting on learning how to be beaten, the greatest is the stupid vanity which leads us to underrate the strength and, above all, the intelligence of our rivals. We know how ruinous this is in war; it is equally so in the conflict between English and foreign manufacturers.

Now that the Universities generally are to be represented, such men as Playfair and Lowe will find a proper sphere, and will, we doubt not, force this matter upon the attention of Government. Whether our present men in office will take up the matter is another affair; on the Continent the idea appears to be that our administrators are too busy with the political questions of the day to do anything towards the advancement either of science or art. Unhappily it needs no ghost to tell us that the "country gentlemen" who do us the honour of governing us, feel very little interest in the matter, and the so-called representatives of the trades are too much occupied with supporting strikes, to see that the prosperity of those whose interests they betray, are in reality dependent upon questions of which violent and uneducated men do not even know the existence.

But all this cannot last for ever; foreigners who only judge of us by our newspapers, ask with astonishment, "But these MM. Broadhead, Beales, and Whalley, who are they?" As soon as our workmen are properly educated they too will ask similar questions; and it will then be seen that the workman's friend is not he who shows him how to strike against his employer, but he who shows him how to develope to the utmost those great gifts of intelligence, patience, skill, and strength which for so many years made British engineers and manufacturers the astonishment of the world.

Before concluding this letter, your correspondent must again protest against the use of exhibitions as *mere* advertisements for the exhibitors. I contend that the committees to whom is delegated the power of acceptance or refusal, should resolutely refuse admittance to articles which do not show upon the face of them the condition of the industry which they represent. When Messrs. Wood and Co. send a few bottles of effervescent drinks which for all that appears might be merely water, I say they should be refused admission. They *may* be of the highest class, but as they stand in the case they show nothing that may not equally well be seen in the window of a restaurant. It is true that one bottle, by leaking a little, tries its best to attract attention, and by pouring out a sorry libation to earth may perhaps get removed to a more congenial sphere where soda-water bottles are at rest.

To return, your correspondent trusts that you, Mr. Editor, will not think that he has dwelt too much upon the subject of the industrial education of the working classes in this country. The question is of vital importance, and it is only by the publicity attainable through the medium of the scientific journals that the inertia of the masses can be successfully overcome.

It shall not be said that I have sent you a letter upon the Paris Exhibition in which no allusion is made to the contents of the building, so I will now proceed with my notes upon the English section.

13. Calley, Samuel, New Road, Brixham, Devon. Specimens of "Torbay," iron oxide paints, and compositions for ships, metal sheathing, &c.

The problem of producing a good sound paint of various colours suitable for wood, iron, and stucco-work, with a base of iron instead of lead, has certainly been creditably solved by Mr. Calley. In addition to extreme cheapness they are free from the deleterious character of lead paints, and are said to be much more lasting. The inventor states that a square yard of iron can be covered for one farthing, and that the labour in applying them is considerably less than with ordinary paints. In fact, from careful experiments it has been ascertained that Calley's paint brought to a working consistency with 45 per cent of its weight of linseed-oil, covered four square yards for one penny, the labour required being only 60 per cent of that required for lead paint. It appears from what we have been able to gather that these paints are principally made from a native oxide of iron found at Brixham in Devon. The paints produced are of two kinds. Those of the first class, which are principally adapted for iron-work, appear to be made direct from the native oxide. Variety of hue is obtained, we believe, by subjecting the ore to various temperatures.

Calley's colours of the second class are tinted by admixture with metallic substances capable of yielding the desired shades. One experiment that was made to determine the comparative resisting powers of lead paint and iron-oxide paint to heat, is certainly sufficiently remarkable to deserve mention. Some sheets of iron were covered on one side with Calley's oxide paint, and on the other with red-lead. One of these, when thoroughly dry, was placed over an open coal-fire, the oxide-painted side downwards. The upper or red-lead side soon began to crack and blister, whilst the oxide-paint still adhered to the iron, and only changed its tint. Infurther trials it was found that at a temperature which approached a red-heat, the oxide paint was only deteriorated, while the red-lead was completely destroyed.

REPORTS OF SOCIETIES.

BRITISH MEDICAL ASSOCIATION,

TWENTY-FIFTH ANNUAL MEETING, 1867, HELD IN DUBLIN.

Dr. Charles A. Cameron read a paper, in the Physiological Section, on the "*Assimilation of Gelatine.*"

The author re-opened the question of the nutritive value of gelatine. He considered that the French Commissioners on this subject had gone too far in denying the alimental value of this substance. He pointed out as strong arguments in favour of his views as to the assimilation of gelatine, the facts—that that substance when largely used as food passes off in the form of urea, and is not found in the fæces. As gelatine passes rapidly from the stomach into the circulating fluids of the body, and becomes decomposed therein, it is impossible not to assign to it some useful functions. The author then described some experiments which he had made on this subject. He employed the dog and the white mouse, the latter animal being peculiarly well-adapted for such experiments. He found that these animals could not live on food consisting of gelatine, fat, butter, sugar, starch, and mineral substances. This was the result the author had expected, for the following reasons. In the nitrogenous portion of animals there exist sensible amounts of organic sulphur and phosphorous compounds ("alloxidic"). Gelatine does not include these elements, and is therefore incapable of forming muscles and nerves. The addition of mineral sulphates and phosphates to gelatine does not increase its nutritive value, because animals are not endowed with the power of organizing mineral sulphur and phosphorus, although this function is the attribute of plants.

In some of the fats of the brain and nervous tissue generally there are notable proportions of organic and unoxidised phosphorus and sulphur. By combining these phosphorised and sulphuretted fats with gelatine, and adding thereto some other non-nitrogenous and mineral substances, Dr. Cameron formed a food on which mice lived for forty-two days in a very healthy state, although the said food was deficient in albumen and fibrin.

Taken under ordinary circumstances, gelatine, according to the author, is most probably employed as a calorifacient, and perhaps also as a source of motive power. In an agreeable form it was a food very much relished by invalids, and there was a good reason underlying the popular practice of making gelatine a common article of food.

Mr. Tichborne read a paper, in the same section, on the "*Organic Matter in Potable Water.*"

He dwelt at some length upon the difficulties attendant upon water analyses. The point of difficulty in the examination of potable waters being not so much their quantitative as the qualitative examination—particularly as regards their organic constituents—you may have a water rich in organic matter yet harmless, or a water containing but a minimum of organic matter of the most deleterious nature. He remarked that all the following points in an analysis had an important bearing upon the state of the organic matter, viz. nitrates, nitrites, ammonia, total nitrogen, odour, taste, colour, hardness, chlorides, iron, gases dissolved, microscopic examination, &c. The author gave a quick method for estimating the nitrites in potable water, based on the conversion by heat of nitrite of ammonium into nitrogen and water—the loss being estimated by a volumetric solution of permanganate of potassium. Mr. Tichborne then described a tube or convenient instrument for viewing the colour of water, and for examining the state of oxidation of the iron salts or matter of some importance in connection with the organic matter, and a point not so easy to determine in very diluted state—as the microscope magnifies the form, so this instrument magnifies the colour, or colour tests, so as to be recognisable

to the eye. When the iron bears any *considerable proportion* to the organic matter, very little of the latter will be found (if we except ammonia), providing the iron is in the state of a ferric salt. If, however, the iron is present as a ferrous salt, it will be found to have exerted little or no influence on the organic matter, and frequently such waters (except chalybeate springs) will be found to contain large quantities of soluble organic matter.

The author remarked that it had been stated that charcoal that had been used some time, so far from taking from the water the organic matter, gives up again a certain amount. That water on analysis before and after passing through old charcoal was more contaminated with organic matter, after having been passed through the said filtering medium. The *modus operandi*, however, by which charcoal acts is not so much by any attractive power that it possesses, that is to say, it does not absorb the mass of the organic matter, but acts as one of the most powerful oxidizers. The oxygen condensed within the charcoal acting more energetically than the available oxygen we can apply in the form of permanganate of potassium. A charcoal filter was found from actual observations to work wonderfully well, and to retain its vitality for a long period, with the following provisions. That the water passed through it did not contain a very large percentage of organic matter. That it was not continuously at work, that is to say, that the charcoal was exposed to the atmospheric oxygen (with as little of the dust as possible) the better part of each twenty-four hours. That the water was passed through a filtering medium before it came in contact with the charcoal. If not, the charcoal acted as a mechanical recipient to the insoluble organic matter, which at last accumulates to such an extent as to enter into a state of fermentative change; the activity of the charcoal being by this time exhausted, or at least only sufficient to supply a minimum of oxygen would only assist such a decomposition. This state of the case would be simply the putrefaction of a mass of organic matter independent of the charcoal, not the rendering back from the charcoal of something it had absorbed from the water.

Mr. Tichborne exhibited a table of the action of permanganate of potassium upon organic substances, which illustrated the worthlessness of that substance as a measure of fermentable matter. He also stated that peroxide of hydrogen, if it could be procured *pure*, and at a reasonable price, might be used with advantage, for the purification of water.

The only other papers read at these meetings, possessing a chemical bearing, were: Dr. Protheroe Smith "*On the Mode of Detecting Impurities in Tetrachloride of Carbon*," and Dr. O'Leary "*On the Thermal Value of Food*," &c.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

New Series of Sulpho-compounds.—A. Saytzeff.—Sulphamylic oxide, $(C_5H_{11})_2SO$, fuses at 37—38°. Zincic ethide, ethylic, or amylic iodide are without action upon it; when heated with hydriodic acid in sealed tubes to 100° a brown oil, insoluble in water, is formed. The acid liquor remaining, after sulphamylic oxide has been separated, contains a small quantity of amylsulphurous acid.

Butylic sulphide, $(C_4H_9)_2S$, is formed by heating butylic chloride with an alcoholic solution of potassic sulphide; it separates from the mixture on addition of water as an oily liquid which, after having been dried and rectified, boils between 176 and 185°; it is insoluble in water, soluble in alcohol and ether. Amylethylic sulphide

$$\left.\begin{matrix}C_5H_{11}\\C_2H_5\end{matrix}\right\}S$$

is obtained by treating sodic amyl-mercaptide,

$$C_5H_{11}NaS$$

with ethylic iodide as a transparent liquid, insoluble in water, and boiling at 158—159°. Treated with fuming nitric acid, the oxide

$$\left.\begin{matrix}C_5H_{11}\\C_2H_5\end{matrix}\right\}SO$$

is formed, besides a trace of an acid, containing sulphur. These observations differ from those of Carius, who gives the boiling point of the sulphide at 132—133·5, and who has obtained ethylsulphurous acid as the only product resulting from the action of nitric acid.

Sulphethylic oxide, $(C_2H_5)_2SO$, is obtained by the action of nitric acid on ethylic sulphide; it is a thick, nearly colourless liquid, which crystallises on cooling. Reducing agents reconvert it again into ethylic sul hide; further oxidation produces diethylsulphan.

Sulphomethylic oxide, $(CH_3)_2SO$, is prepared, like the ethyle-compound, by acting upon methylic sulphide with strong nitric acid; the same reaction gives rise to the formation of nitrate of sulphomethylic oxide

$$(CH_3)_2SO.HNO_3$$

which is a crystallisable, deliquescent salt. If a solution of the methylic sulphide in nitric acid is heated for several hours in a sealed tube methylsulphan is formed, which is soluble in water, fuses at 109° and boils at 238°. The action of methylic iodide on amylethylic sulphide was expected to result in the formation of the compound $S(CH_3.C_2H_5.C_5H_{11})I$; instead of this, however, iodide of trimethylsulphin $S(CH_3)_3I$ was formed, besides ethylic and amylic iodide.—(*Zeitschr. Chem.* N. F. iii. 358.)

Sodic Hydrate, Crystallised. — E. Schöne. A hot saturated solution of sodic hydrate begins to crystallise when cooled to between 40 and 50°. The crystals have the composition Na_2O+5H_2O or $Na_2H_2O_2+4H_2O$. They are very deliquescent, but after being throughly dried upon a porous surface under the dessicator, do not fuse below 80°.—(*Zeitschr. Chem.* N.F. iii. 383.)

Thionessal.—M. Fleischer. The formula of thionessal according to the author is $C_{28}H_{20}S$, instead of $C_{26}H_{18}S$ as stated by Laurent and Märker. Bromine substitutes three atoms of hydrogen, forming $C_{28}H_{17}Br_3S$ which may be obtained in crystals from its solution in petroleum (of a high boiling point) fusing at 265°—267°. This compound again treated with bromine is converted into $C_{28}H_{16}Br_4S$. Potassic chlorate and chlorhydric acid oxidise all the sulphur of thionessal into sulphuric acid, converting it thereby into the compound $C_{14}H_{10}O$, which fuses at 214°. Phosphoric chloride forms C_7H_5Cl (or xC_7H_5Cl), fusing at about 130°. Fuming nitric acid first produces the nitro-compound $C_{28}H_{16}(NO_2)4S$ which subsequently is converted into a body, free from sulphur, probably $C_{14}H_{10}(NO_2)_2O_3$, and finally into nitrodracylic acid. Fuming sulphuric acid dissolves thionessal with disengagement of sulphurous acid and formation of the acid $C_7H_6SO_4$, the baric salt of which has the composition $(C_7H_5SO_4)_2Ba,4H_2O$. The compound produced by the action of soda-lime seems to be tolallylic sulphide $C_{14}H_{10}S$.—(*Zeitschr. Chem.* N.F. iii. 376).

Mercuric Naphtide.—R. Otto. Sodium-amalgam was made to act upon monobromnaphthalene, diluted with several times its volume of benzol (boiling between 120 and 140°) in the hope of getting dinaphtyl

$$\left.\begin{matrix}C_{10}H_7\\C_{10}H_7\end{matrix}\right\}$$

The reaction, however, proceeded differently—mercuric naphtide being formed according to the equation :—

$$2\left.\begin{matrix}C_{10}H_7\\Br\end{matrix}\right\} + Na_2Hg'' = \left.\begin{matrix}C_{10}H_7\\C_{10}H_7\end{matrix}\right\}Hg'' + 2NaBr$$

Mercuric naphtide, which may thus be prepared with ease, and in any quantity, crystallises in white needles, soluble in hot benzol, sparingly so in alcohol, insoluble in water; they fuse at 248°.

When heated with lime naphtalene principally is formed, but no dinaphtyl. Iodine combines with mercuric naphtide, forming mercuric di-iodmercaptide,

$$\left.\begin{matrix}C_{10}H_7\\C_{10}H_7\end{matrix}\right\}HgI_2$$

which crystallizes from hot alcohol in beautiful silky needles. Bromine added in excess acts in the following manner:—

$$\left.\begin{matrix}C_{10}H_7\\C_{10}H_7\end{matrix}\right\}Hg+4Br=\underset{\text{Naphtalenic bromide.}}{\left.\begin{matrix}2C_{10}H_7\\Br\end{matrix}\right\}}+HgBr_2$$

By the action of sodium-amalgam sulphonaphtalenic chloride is resolved into naphtalene and sulphurous acid:—

$$\left.\begin{matrix}C_{10}H_7SO_2\\Cl\end{matrix}\right\}+2H=SO_2+HCl+C_{10}H_8$$

(*Zeitschr. Chem.* N. F. iii. 377.)

Isomer of Ethylamyle, and Observations on Mixed Ether.—Reboul and Truchot. When hexylic chloride is acted upon by alcoholic potassic hydrate, hexylene C_6H_{12} is formed (Pelouze, Cahours), but besides this ethylhexyl; heptylic, octylic and decylic chloride likewise are converted into both the hydrocarbon and mixed ether; amylic chloride gives chiefly ethyl-amyle, but also some amylene, even ethylic bromide yields besides ethylic ethide, ethylene. This reaction, therefore, is a general one, the members of the series differing in this respect, that the lower ones give rise to the formation of mixed ether principally, while those of higher atomic weight yield hydrocarbon more abundantly. By the action of alcoholic potassic hydrate upon amylenic bromhydrate a body is obtained of the composition of ethyl-amyle, but differing from the latter in boiling-point by about 10°, as also in its behaviour towards hydrobromic acid,—ethyl-amyle forming ethylic and amylic bromide, the isomer ethylic bromide and amylenic bromhydrate. The authors propose for the isomeric compound the formula:—

$$C_5H_{10}\left\{\begin{matrix}H\\C_2H_5O\end{matrix}\right.$$

(*Comptes R.* lxiv. 1243.)

NOTICES OF BOOKS.

Germinal Matter and the Contact Theory. James Morris, M.D. Lond., Fellow of Univ. Coll., Lond. London: John Churchill and Sons, New Burlington Street. 1867.

The author of this small pamphlet of twenty-three pages, in the first enters his plea in the following skilful manner,—"Depreciation due only to baseless theories is too often extended to theory in general, but even a theory that does no more than harmonize a large number of facts, is a useful aid to further progress, and is often the means by which we arrive at a law." As a rule the largeness of the number of facts is in direct ratio to the looseness of the theory, as opposed to law. A medical theorem is then worked out *seriatim*, by what the author calls three easy steps; we may call them his axioms.

Axiom I. "Air floats with ease and for a considerable time and distance, light, and small masses of organic matter." Well-known facts are quoted for this, but a certain vagueness of expression somewhat tends to embarrass the reader, *e.g.*, "Seeds of *all sizes* sail in the air, from the thistle or taraxacum, with their parachutes of bristles, down to the smallest floated by its thread of cotton." A rigidly accurate reader might feel disposed to quibble about this statement, as is his wont; seeds of all sizes include horse-chesnut and cocoanut seeds, and evidence of their being floated by air is still wanting.

Axiom II. Minute portions of organic matter are constantly thrown off by animals and men.

Axiom III. These are received into the body, and some pass into the lungs so as to reach the blood.

These are not to be disputed, and the theorem follows, "Light little masses from the body of one individual are constantly received by other individuals so as to reach their blood."

An interesting number of facts are in the next place cited, to show what diseases are known to be caused by essentially molecular causes, those known to be caused by organic (*i.e.* organized) agencies; thirdly, the grounds for suspecting their presence in other diseases. Dr. Beale's researches are also quoted in terms of the highest praise; "to him we owe the outline of what I conceive to be a generalization, hereafter probably to rank as a landmark in medical science." The pamphlet as a whole we esteem highly, more especially for its clear ordination of facts, and the plainly stated facts for the axioms necessary to work out a theorem. Dr. Morris is an author whom it is very easy to follow in argument, and it is a pleasure to read a pamphlet written on his plan; these good points are so much enhanced by comparison with works that now-a-day abound with theorems without axioms, based neither upon experiment with full details, nor upon high authority with references, judiciously selected.

Propriétés Desinfectants des Permanganates Alcalins. Henry Bollman Condy. Paris: J. B. Baillière et Fils. 1867.

The readers of the Chemical News doubtless remember the tenor of some remarks made in this journal under the heading, "French Academicians and English discoverers;" from our later numbers also they have learnt that Sir Isaac Newton himself is not to escape; and although we are sorry that Mr. Condy should have occasion to assert his right of priority of discovery, we congratulate him heartily at finding himself in such good company, and ourselves for this opportunity of learning the whole history of the application of the permanganates to disinfection, afforded by the necessity of publishing such a claim.

Mr. Condy observes truly, that although M. Marguerite in 1850, and MM. Bussy, Florés-Domonte, and Péan de Saint Giles still later, advocated the application of the permanganates and manganates for oxidizing purposes; they did so merely for purposes of chemical analysis; and the proof of commercial application being still unrecognized, is found in there being no exhibition of these salts at the French Exhibition of 1855. Towards the end of this year Mr. Condy first showed these disinfecting powers. We have in Appendix A the most complete verification of Mr. Condy's views from the highest authority, Professor Hofmann; this document is dated July 21, 1856. In spite of this M. Castex claimed, in 1863, from the Academy of Sciences, a recognition of his discovery of these properties. Mr. Condy thereupon, by Dr, Mitchell, addressed to the Academy a most unanswerable reply to M. Castex's claims. This called forth in reply a letter addressed to the Academy by a Dr. Blache (March 24, 1864), and this will be for some time memorable in the history of invention as an unexampled specimen of cool impertinence; we quote—

"Et puis nous ferons remarquer que ce n'est pas l'idée seule *qui fait le merite* d'un travail, surtout d'un travail qui a un but pratique; c'est la poursuite de cette idée dans les faits . . . . M. Castex a experimenté par lui-même; il nous fait connaître des faits puisès dans sa propre pratique. Ces faits sont bien à lui. Ces faits ne sont pas ceux de M. Condy; et s'ils confirment ceux de M. Condy, tant mieux"!!

Dr. Blache admits the discovery, but disputes the full demonstration by a series of experiments, in effect, if not directly, by attributing such a series of experiments to somebody else.

The history of this case may be taken as a pattern of the flimsy way in which French chemists have lately been in the habit of making discoveries. We can discover nothing in Mr. Condy's language that shows anything but the strictest courtesy, truth, and confidence in the justice of his claim.

CORRESPONDENCE.

EQUIVALENCE, QUANTIVALENCE, AND CHEMICAL VALUE IN EXCHANGE.

To the Editor of the Chemical News.

Sir,—In an able review of an excellent book (Dr. Miller's "Elements of Chemistry") published in your current number, I observe an error, evidently inadvertent, yet of a kind so frequently made, and tending so much to confusion of thought, on topics which it is essential to keep clear in the mind, that a few lines of your valuable space may not, I think, be misapplied in its correction.

In the absence of my friend Dr. Hofmann, this duty devolves, I feel, upon me; because the error in question consists in the misquotation of a term proposed by us, in lieu of the vague, and, as your critic justly calls it, "barbarous" expression *atomicity*. The substituted appellation is not, as your reviewer writes, (doubtless by a mere slip of the pen), "*equivalence*," but "*quantivalence*."

As *both* these expressions are retained by us, each having, in our view, its special scientific value, and only the meaningless word "atomicity" being abandoned, it is absolutely essential to philosophical precision that the two words in question should be scrupulously employed, each only in its peculiar sense, as contra-distinguished from the appointed meaning of the other.

Now, the term "equivalence" is set apart to denote the *molecule-forming* power of an element, while "quantivalence" is expressly reserved to signify its *atom-fixing* capacity.

Both these are essentially ponderal values—capable of being numerically expressed as combining-weights, in terms of the same standard unit, viz., H = 1.

The molecule-forming power of any element corresponds with the minimum-weight thereof, relatively to hydrogen as unity, capable of taking part in the formation of a compound molecule.

The atom-fixing capacity of any element is proportional to the minimum-weight thereof capable of engaging, or conversely, of expelling and replacing, one standard atom; H = 1 being the standard.

The former of these two values constitutes, for each element, its *equivalent*, in the ordinary acceptation of the word, which is synonomous with *atom-weight*, and *combining number*. It will be remembered that, for the volatile elements, these equivalents correspond *(exceptis excipiendis)* to the respective *gas-volume-weights*, or *vapour-densities*, relatively to hydrogen taken as unity.

The latter of the two values, as I have elsewhere pointed out, might properly be represented, for each element, by attaching to it a second ponderal equivalent, or representative number, most frequently a fraction of the former,—a moiety, a third, or a fourth,—to denote the smallest quantity by weight capable of fixing, or replacing one standard atom.

This mode of notation would give us two parallel sets of minimum-weights, or combining numbers, each element possessing a pair; and the two being distinguishable, in most cases, as the *major* and *minor* equivalent.

I say "in most cases" because, for chlorine and its congeners, the two equivalents would coincide.

These duplicate equivalents, for the typical elements, would be, respectively, in terms of hydrogen as unity:—

	Major.	Minor.
For oxygen	16 ..	8
,, nitrogen	14 ..	4·66
,, carbon	12 ..	3

while, for chlorine, 35·5 would represent both values.

It is, however, obvious, that the extension of such a duplicate system to 62 or more elementary bodies, would severely tax the memory and the attention, (faculties of sadly limited scope, always to be most studiously husbanded), besides also seriously impairing the succinctness of the symbolic notation, so invaluable as our chemical "short-hand."

This short-hand, as commonly practised, represents each element by its initial letter, with which we associate, by a comparatively easy habit of the memory, its molecule-forming minimum-weight, or ordinary combining equivalent.

The symbol, so far prepared, is ready to have engrafted on it the further conception of *quantivalence*; which we can now exactly define.

"Quantivalence" is the atom-fixing power of the respective elements, denoted, for each typical group, by a special coefficient, whereof the index is attached, for each member of the group, to the initial letter with which is associated its name and ordinary equivalent number; the result being an exceedingly concise symbol, embodying, together with a Name, two distinct conceptions of chemical Value, with their respective Quantities.

As all the simple bodies fall naturally, in respect of their quantivalence, into four typical groups, headed respectively by the four elements cited above, the members of each group, how different soever their molecule-forming weights, correspond with each other as *uni*valent, *bi*valent, *tri*valent, or *quadri*valent, in their atom-satisfying relations.

We have only, therefore, to bear in mind this easily-rememberedfourfold classification, with its simple quantivalential indices (dashes or Roman numerals at choice), in order to have constantly at hand for use, all the information that the long lists of duplicate equivalents, so burdensome to the memory, must otherwise have been employed to supply.

The disburdenment of memory, and the terseness of symbolisation, thus simply attained, acquire additional value from the happy circumstance that the atom-fixing and volume-condensing powers of the elements advance *pari passu*; so that, *(exceptis excipiendis* once again) the coefficients of quantivalence serve to condense into our symbols, and so to keep impressed upon our minds, besides the several ranges of facts above mentioned, this further collateral information.

Confining attention, however, to the main conceptions, distinct though allied, of equivalence and quantivalence as above defined, it is by carefully coupling these together, yet as carefully avoiding to confuse them, that we are enabled to contemplate accurately, in its two opposite aspects, that which I have ventured to term *Specific chemical value in exchange*.

Nothing, I think, can now be clearer than that this value, so frequently misunderstood, presents itself in two aspects, and as of two kinds, accordingly as we contemplate it relatively, on the one hand, to the formation of molecules, or, on the other, to the fixation or displacement of atoms.

Adopting the first stand-point, we clearly perceive that 12 parts by weight of carbon are "worth" (in financial parlance) as much as 14 of nitrogen, 16 of oxygen, 35·5 of chlorine, and so forth.

Placing ourselves at the second point of view, we as clearly see that an atom of any element in the quadrivalent group is "exchangeable at par" for four atoms of

any element in the univalent group, and for three and two atoms respectively, of any element in the trivalent and bivalent groups.

I should trespass unduly on the hospitality of your valuable columns, were I to prolong these elucidations, otherwise I would fain trace out a little further the nature and consequences of these admirable relations. Among other such illustrations on which I would gladly dwell is one that I was permitted to adduce in a little book which you were pleased to notice with approval on its first appearance, and which your reviewer cites. I allude to the curious and beautiful quantivalential equipoise, or symmetry, which I have observed to prevail among the five members of the nitroxygen series.

These singular relations will be found displayed at pp. 181, *et seq.*, of the work referred to, in a diagram expressly constructed to show the characteristic feature of this remarkable series; with its central body in the self-balanced structural condition, which I have ventured to call *equiquanticity*; while its two wings form exact quantivalential counterparts, equal, though conversely reflecting one another, as each departs, by opposite grades of declension, from that self-centred archetype.

I forbear, however, from a dissertation which would tempt me too far; and, reverting to the purpose with which I set out, I beg, in conclusion, by way of summary,—while acknowledging your reviewer's manifest ability—to deprecate the confusion which his *lapsus calami* (nor his alone) tends to introduce between conceptions so fundamentally distinct as those of chemical *equivalence* and *quantivalence*; signifying as they do, two opposite forms or aspects of "chemical value in exchange,"—those, namely, which we trace, respectively, in the *molecule-forming* and *atom-fixing* powers of the elements.—I am, Sir, &c.,

F. O. WARD.

London, August, 1867.

MAGNETISM AND GRAVITATION.

To the Editor of the Chemical News.

"A. D." admits that the force of magnetic attraction varies inversely as the square of the distance, and yet arrives at the singular conclusion that "when the distance between the pole of a magnet and a magnetic body is very considerable as compared to the size of the latter, the body will not be attracted." According to "A. D.'s" views, therefore, if a small particle of iron, say a single molecule, were placed at a distance of a quarter of an inch from the pole of a magnet, it would not be attracted, because the distance of a quarter of an inch would be inconceivably great compared with the length of a molecule of iron. Now, if this holds good for one molecule of iron, it holds good for any number of molecules, for the attraction of a mass may be regarded as made up of the attraction of the molecules of which it is composed. So that "A. D.'s" process of reasoning, legitimately carried out, leads to the remarkable result that a piece of iron would not be attracted by the pole of a magnet placed at a distance of a quarter of an inch from it, "which," to quote a well-known author, "is absurd."

It must be borne in mind that all I have contended for is that, theoretically speaking, just as a magnet placed under a balance increases or diminishes the apparent weight of certain substances introduced into the pan of the balance, so the weights of substances, at ordinary temperatures, on the earth's surface are not their absolutely true weights. That is to say, they are not entirely due to the force of gravitation, but a part, it may be an inconceivably small part, of the apparent weight, is due to the magnetic attraction and repulsion of the earth, and of the atmosphere by which it is surrounded.

On this point I would quote "Watts's Dictionary," vol. iii., p. 774, where we read that "a cubic mètre of oxygen gas would act on a magnetic needle with the force of 54 centigrammes of iron, and a cubic mètre of air with the force of 11 centigrammes of iron. The whole atmosphere is consequently equal in magnetic power to a shell of iron covering the whole earth to the thickness of 0·1 millimètre."

If bodies were weighed at high temperatures, that portion of their weight which was due to the magnetic attraction of the earth, would almost entirely disappear, and hence the weight of a given quantity of iron would be, theoretically, less if weighed at a red heat than if weighed at ordinary temperatures.—I am, &c.,

JOHN A. R. NEWLANDS, F.C.S.

Laboratory, 19, Great St. Helen's, E.C., Aug. 13, 1867.

CO-OPERATIVE CHEMICAL CLUB.

To the Editor of the Chemical News.

SIR,—It occurs to me that in these days of co-operation, it might be a good thing to form "chemical and physical clubs" in various parts of the country wherever sufficient numbers of co-operators could be obtained. There are many, I daresay, like myself engaged in commerce, manufactures, or the professions, who love science for its own sake, and from various causes cannot acquire a laboratory worthy of the name, who would gladly contribute a considerable sum yearly for the privilege of having the use of a well-stored laboratory, and intercourse with others having similar tastes and pursuing similar studies. If there were clubs of this sort in all our large towns, I am sure they would tend greatly to advance the cause of science and to spread a *correct* knowledge of it in many quarters where at present it is but little understood.

It would tend to success were some influential gentleman to bring the subject before the British Association next month, and have clubs instituted under its auspices.

If you consider this idea at all practicable, I shall be obliged by your inserting it in your widely-circulating journal.—I am, &c. WM. DURHAM.

Currie, near Edinburgh, August 17, 1867.

[The idea is excellent, and we shall be happy to give it all the support in our power.—ED. C.N.]

SPECIFIC GRAVITY PROBLEM.

To the Editor of the Chemical News.

SIR,—Your correspondent "C. H. P." may well be astonished at the reduced sp. gr. of the iron as obtained by his calculation (1·10506). He will find, however, that this lowness is due entirely to the mistake which has been allowed to creep into the method adopted for ascertaining it, and not at all to any error in the observations of *Sidcros*, for, working the problem out correctly from them, the sp. gr. is obtained nearly double what it should be, if the substance is iron! The system he has adopted is a proper one, and that given in "Fownes" (in the 8th ed., page 8) for finding the sp. gr. of substances lighter than water, and may be applied to this case thus:—

Weight of iron and olivine in air	50 gns.
" " " " water	41·8 "
Weight of water equal in bulk to iron and olivine	8·2 "
Weight of olivine in air	20· "
" " " water	13·75 "
Weight of water equal in bulk to olivine ..	6·25 "
Weight of water equal in bulk to olivine and iron	8·2 "
Weight of water equal to olivine alone ..	6·25 "
Weight of water equal in bulk to iron	1·95 "
Weight of iron in air .. .. $\frac{30}{1·95}$	= 15·384 =
Weight of water equal in bulk to iron	

=sp. gr. of the iron according to *Sideros*' proposition, which brings it to the same result as in my calculation of last week. "Lloyd" would have obtained a more accurate result also with his ingenious formula, had he not unfortunately made a mistake in multiplying $3{\cdot}2\times6{\cdot}1\times30$, which is 585·6, and not 575·6, as given in his solution.

The method worked out above is accurate, but it may be interesting to consider the reasoning by which a shorter method for working out all problems of this character may be arrived at.

Supposing a body weighing A grains in air,
weighs in water .. .. *a* grains.
And another body weighing B grains in air,
weighs in water .. .. *b* grains.
Then the two together ,, A+B ,, ,,
will weigh in water .. .. *a+b* gns.

This is self-evident, it only requires stating to be perceived, for the body which weighs A in air will displace the same bulk of water when attached to or mixed with that weighing B, that it did when by itself, and the same holds true of that weighing B; consequently their united action on the balance must be the sum of the weights obtained when immersed separately. This established, it will be easy to see that if a body weighing A+B in air, weighs in water $a+b$, and one of its components weighs A in air, and in water weighs a, then the second component weighing B in air, must in water weigh b. This last term, which is all that is wanted for obtaining the sp. gr. of the second component, being obtained by substracting a from $a+b$ in the same way that its weight in air was obtained by deducting A from A+B.

Bearing in mind the nature of the difference between those substances which are heavier and those which are lighter than water, this system becomes applicable to the solution of the interesting problem of finding the sp. gr. of substances of the latter class; all that is required being great attention in the use of the signs during the calculation.

As an example, let us take that in "Fownes," already alluded to. The problem is to find the sp. gr. of a piece of wax, this is attached to a piece of brass in order to make it sink in water.

Brass and wax together in air weigh 183·7 grns., in water 38.8
Brass alone in air weighs .. .. 50 ,, ,, ,, 44·4
Substracting we obtain— ——
Wax alone in air .. .. 133·7 ,, ,, ,, −5·6

But to find the sp. gr. of a substance, we must deduct the weight in water from that obtained in air, and this difference becomes the denominator of a fraction representing the sp. gr. of the substance, and of which the numerator is its weight in air, *i.e.*—

In this case the sp. gr. of wax =

$$\frac{133{\cdot}7}{133{\cdot}7-(-5{\cdot}6)}=\frac{133{\cdot}7}{133{\cdot}7+5{\cdot}6}=\frac{133{\cdot}7}{139{\cdot}3}=0{\cdot}9598.$$

F. J. R. C.

To the Editor of the Chemical News.

SIR,—I send you herewith particulars of two experiments, which for my own satisfaction I have made, and in case you may think them worthy of record they are at your service.

The olivine employed was in pure translucent yellow fragments from Vesuvius—the iron being common iron wire. The sp. gr. of both were determined with care.

A. Weight of some fragments of olivine, sp. gr.

3·19, was .. .. 20·33 grs.
Do. of iron wire, sp. gr. 7·51 .. .. .. 30·21 ,,
Consequent weight of iron+olivine was .. 50·54 ,,

And the sp. gr. of same taken together was found to be 4·87.

Supposing the problem put in the form proposed by *Sideros*, the formula of "F. J. R. S." would give—

Weight of iron+olivine in water=
=50·54−(50·54÷4·87)= .. .. 40·17
Deduct weight of olivine alone in water=
=20·33−(20·33÷3·19)= .. .. 13·96
Gives weight of the 30·21 grs. iron in water= .. 26·21

and $30{\cdot}21\div(30{\cdot}21-26{\cdot}21)=7{\cdot}55$ sp. gr. of iron required.
According to "Lloyd's" formula.—

$$\frac{3{\cdot}19\times4{\cdot}87\times30{\cdot}21}{(3{\cdot}19\times50{\cdot}54)-(4{\cdot}87\times20{\cdot}33)}=\frac{469{\cdot}321413}{62{\cdot}2155}=$$

=7·54 sp. gr. of iron required.

B. Another experiment gave following results :—

Weight of olivine of sp. gr. 3·20 employed = .. 20·32
,, of iron ,, 7·87 ,, = .. 33·55
Total weight of iron+olivine being .. .. .. 53·87

The specific gravity of which conjointly was 5·09. As before "F. J. R. S's." formula gives—

Weight of iron+olivine in water=
53·87−(53·87÷5·09)= .. .. 43·29
Deduct weight of olivine alone in water=
=20·32−(20·32÷3·20)= .. .. 13·97
Gives weight of the 33·55 grs. iron in water .. .. 29·32

And 33·55÷(33·55−29·32)=7·93 specific gravity of iron.
Or by "Lloyd's" formula—

$$\frac{3{\cdot}20\times5{\cdot}09\times33{\cdot}55}{(3{\cdot}2\times53{\cdot}87)-(5{\cdot}09\times20{\cdot}32)}=\frac{546{\cdot}46240}{69{\cdot}9552}=$$

=7·81 sp. gr. of iron.

The difference being probably in part at least due to errors of observation. D. F.

MISCELLANEOUS.

The British Association.—The official programme of the 37th annual meeting of the British Association at Dundee has just been issued. It furnishes the following details :—The Royal Exchange Reading-room will be opened as a reception-room on Monday, September 2, for the issue of tickets to members, associates, and ladies, and for supplying lists and prices of lodgings, and other information to strangers on their arrival. The member's ticket contains a map of Dundee and particulars as to the rooms appointed for sectional and other meetings. For the convenience of members and associates a branch post-office (which will be available also for communication between members attending the meeting) will be opened for this occasion in the reception-room. Members and associates may obtain railway pass-tickets and information of local arrangements on application to the local secretaries at Dundee. The general committee will hold its first meeting in Panmure-street Chapel on Wednesday, the 4th September, at 1 p.m., for the election of sectional officers and the despatch of business usually brought before that body. The general committee will meet again in Panmure-street Chapel on Monday, the 9th of September, at 3 p.m., for the purpose of deciding on the place of meeting in 1868. The concluding meeting of this committee will also be held in Panmure-street Chapel, on Wednesday, the 11th of September, at 1 p.m., when the report of the Committee of Recommendations will be received. The first general meeting will be held in the Kinnaird Hall on Wednesday, September 4, at 8 p.m. precisely, when Mr. W. R. Grove, Q.C., M.A., F.R.S., &c., will resign

the chair, and his Grace the Duke of Buccleuch, K.G., F.R.S., &c., will assume the presidency and deliver an address. The different sections will assemble in the rooms appointed for them for the reading and discussion of reports and other communications, on Thursday, September 5; Friday, September 6th; Saturday September 7th; Monday, September 9th; and Tuesday, September 10th, at 11 a.m. precisely. The sections are the following:—A.—Mathematical and Physical Science—In the High School. President, Professor Sir W. Thomson, D.C.L., F.R.S., &c. Vice-Presidents, Professor Kelland, F.R.S., Mr. Clerk Maxwell, F.R.S. Secretaries, Professor Clifton, M.A., Professor G. C. Foster, M.A., Professor Swan, F.R.S.E. B.—Chemical Science—In the High School. President, Professor Thomas Anderson, M.D., F.R.S.E. Vice-Presidents, Mr. Maxwell Simpson, F.R.S., Professor Williamson, F.R.S. Secretaries, Mr. A. Vernon Harcourt, Secretary C.S., Professor Liveing, M.A., F.C.S., Dr. Russell F.C.S. C.—Geology—In Panmure-street Chapel. President, Mr. Archibald Geikie, F.R.S., F.G.S., Vice-Presidents, Sir Philip Egerton, F.R.S.; Professor Ramsay, F.R.S. Secretaries, Mr. W. Pengelly, F.R.S., Mr. H. Sorby, F.R.S. D.—Biology.—In the High School. President, Professor Sharpey, Secretary R.S.; Vice-Presidents, Professor Allman, F.R.S., Sir John Lubbock, F.R.S. Secretaries, Dr. Spencer Cobbold, F.R.S., Mr. H. L. Stainton, F.R.S., Rev. H. B. Tristram, M.A., F.L.S., Professor W. Turner, M.B., F.R.S.E., Mr. E. B. Tylor. E.—Geography and Ethnology.—In the Albert Institute. President, Sir Samuel Baker, F.R.G.S. Vice-Presidents, Mr. John Crawfurd, F.R.S., Sir Roderick Murchison, F.R.S. Secretaries, Mr. H. W. Bates, Assistant Secretary Geographical Society; Mr. Clements R. Markham, F.R.G.S.; Mr. O. W. Nash, Mr. Thomas Wright, M.A. E.—Economic Science and Statistics.—In Euclid-street Chapel. President, Mr. M. E. Grant Duff, M.P., M.A. Vice-Presidents, Dr. Farr, F.R.S.; Colonel Sykes, M.P., F.R.S. Secretaries, Professor Leoni Levi, F.S.A.; Mr. Edmund Macrory. G.—Mechanical Science.—In Watt-hall, Constitution-road. President, Professor W. J. Macquorn Rankine, LL.D., F.R.S. Vice-Presidents, Mr. W. Fairbairn, F.R.S., General Lefroy, R.A., F.R.S. Secretaries, Mr. P. Le Neve Foster, M.A. The sectional officers will be proposed for election to the General Committee on Wednesday, September 4. The following general and evening meetings have been arranged:—On Wednesday evening, September 4, at 8 p.m. in the Kinnaird-hall, the President's address. On Thursday evening, September 5, at 8 P.M., in the Volunteers' Hall, soiree. On Friday evening, September 6, at8.30 p.m., in the Kinnaird-hall, a discourse will be delivered by Mr. Archibald Geikie, F.R.S., director of the Geological Survey of Scotland, on the Geological Origin of the present Scenery of Scotland. On Monday evening, September 9, at 8·30 p.m., in the Kinnaird-hall, a discourse will be delivered by Mr. Alexander Herschel, F.R.S., on Shower-Meteors. On Tuesday evening, September 10, at 8 p.m., in the Volunteer Drill Hall, soiree. Wednesday, September 11, concluding general meeting at 3 P.M. Excursions on Saturday, September 7, and Thursday, September 12.

The Poisonous Action of Phosphorus.—Contrary to the current doctrine that death in case of poisoning by phosphorus results from fatty degeneration of the liver, produced by phosphorous acid, M. Dybkowsky states in a recent memoir that the toxic result is entirely due to the formation of phosphuretted hydrogen gas, which in passing through the blood completely uses up the oxygen present. Hence he concludes that death from phosphorus is nearly equivalent to death by asphyxia.—*Medical Times and Gazette.*

Methylated Spirits.—After the 1st of October next the duty on licences to retailers of methylated spirits is to be reduced to 10s. per year.

Technical Education.—The following extract from *The Times*' account of the "safe contest," forms an appropriate commentary on the remarks on Technical Education in the supplement to last week's CHEMICAL NEWS:—"Mr. Herring's workmen were three intelligent Germans—one of them a man of marked ability—he spoke three languages—and went about his business in the most scientific way. Mr. Chatwood's men were three Lancashire men, who represented brute force rather than intellect. One of them had a wonderful touch both for power and precision; but that was the only thing remarkable in the party. Any one who saw the contest between these two sets of workmen would carry away a very vivid idea as to the nature of the race which is now being run between the manufactories of England and those of the Continent. It is an admitted fact that the Continent has made an immense stride in advance, that the progress which we in England have made in the last 15 years is as nothing compared with that which our continental rivals have made, and that it will cost us a good deal in the future not merely to hold our own, but to save ourselves from being disgracefully beaten. The chief reason which the most intelligent observers assign for this change in our position as manufacturers is to be found in the superior education of the continental workman. He has gone through a regular course of instruction at some polytechnic school, he has been trained to appreciate principles, and he brings the exercise of brain to his work. An English foreman is of another stamp. He has had no special education; he has risen from the ranks; he knows his business by rote and rule of thumb; long practice has given him a certain mechanical facility of touch, but science he has none. By the very laws of the trade to which he belongs science is in a manner forbidden to him. Science will teach him to do in an hour what hitherto has occupied him two hours. This science is expressly forbidden him, because it would interfere with the wages of his comrades and take the bread out of their mouths."

Silicates of Methyl.—C. Friedel and J. M. Crafts, first tried to prepare this body by reacting on methylic alcohol with chloride of silicium; like Ebelmen, they obtained a product impossible to purify, turning brown in the air and possessing a fœtid odour. They noticed that this product always contained chlorine. Wood spirit was purified by treatment with chloride of calcium; the chloride of calcium compound decomposed with water, and the alcohol rectified several times with sodium. The alcohol thus prepared was sealed in a tube with silicate of ethyl, and the mixture heated during 20 hours at 210° C. After several fractional distillations the principal product isolated from the contents of the tube was a liquid boiling at 143° to 147°. This liquid gave on analysis numbers which correspond with the composition of a mixed silicate, diethylic, dimethylic, silicic ether. There being reason to believe that a minute trace of water contained in the methylic alcohol interfered with the success of the processes in which it was employed, this alcohol was distilled twice with sodium, then with a small quantity of anhydrous phosphoric acid. Thus prepared, it boils at 65·5°, has not the disagreeable odour it usually has, smells like common alcohol, and does not turn brown with soda. Methylic alcohol purified in this way, when added to chloride of silicium, reacts like ordinary alcohol. When the theoretical quantity of the alcohol has been added, the product is distilled, and after a small number of fractional distillations two principal products are obtained, one boiling at 120° to 122°, and the other at 201° to 202·5°. The first is the normal silicate of methyl; the second is the hexamethylic disilicic ether. The normal silicate of methyl is a colourless liquid, has rather an agreeable odour, is soluble in a considerable quantity of water. Moisture or aqueous alcohol gives rise to condensed products, ultimately silica. It burns with a white smoke composed of silica.—*Silliman's Journal*, May, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Comptes Rendus. May 20, 1867.

BOUSSINGAULT, "On the Effects of Mercury Vapours on Plants." LIEBIG, "On Artificial Milk for Infants." GUYON, "On the Effects of the Sting of the Scorpion." F. TEYNARD, "On the Calculation of the Numerical Elements of a Simple Achromatic Objective for Photography." NAMIASS, "On the Use of Bromide of Potassium as a Remedy for Epilepsy." C. FLAMMARION, "On a Change which has taken place in the Crater of Linnæus in the Moon." CHACORNAC, "On the same subject." J. B. BAILLE, "Researches on the Variations in the Dispersive Power of Liquids under the Influence of Heat." VELTER, "On the Effects of Silicate of Potash when applied as a Manure on the Laying of Cereals, and on the Strength of the Stems of Cereals." FRITZSCHE, "On the Solid Carbides of Hydrogen obtained from Coal." S. DE LUCA, "Analysis of Water from a Bronze Vase discovered at Pompeii." M. PERRET, "An Improved Wine Fermenting Vat." A. BECHAMP, "On Pasteur's Memoir on the Corpuscles of the Silk Worm Disease." "Some new Facts on the present Silk Worm Disease, and on the Nature of the Vibrating Corpuscle." BALBIANI, "On the Supposed Reproduction by Fission of the Corpuscles or Psorosperms of the Silk Worm Disease." E. CYON, "On the Influence of Carbonic Acid and Oxygen on the Heart."

May 27.

T. GRAHAM, "On the Occlusion of Hydrogen Gas by Meteoric Iron." J. FOURNET, "On the Path of Storms in the Department of the Rhone." P. DESAINS, "Researches on the Absorptive Action of Ether and Formic Ether and their Vapours on the Heat radiated from a Lamp furnished with a Glass Chimney." A. WURTZ, "On the Synthesis of Methyl-Allyl." C. MENE, "An Analysis of some Crystallized and Amorphous Graphites." D. DE LUCA, "On the Use of Crystallized Sulphate of Soda for restoring the Transparency of the Cornea." HULOT, "On the Use of Aluminium Bronze for making the lower Die of Machines for Perforating Postage Stamps." H. DEVILLE, "On Hulot's Improved Hard Solder, formed by mixing Zinc-amalgam with ordinary Solder." "On the Rapid Oxidation of Alloys of Lead and Platinum when exposed to the Air." E. DUCLAUX, "On a Hydrate of Bisulphide of Carbon."

June 3.

E. BECQUEREL, "Notice of the Author's Work on 'Light, its Causes and Effects.'" L. PASTEUR, "Two Letters to Dumas on the Silk Worm Disease." A. SECCHI, "Resumè of Observations on Sun Spots for the first Six Months of the year 1866." "On the reported Disappearance of the Crater of Linnæus in the Moon." J. CHAUTARD, "Researches on the Magnetism and Diamagnetism of Gases." J. ROSENTHAL, "On Phenomena observed in Cases of Poisoning by Strychnine." LE RICQUE 'DE MONCHY, "On the Use of Creosote in the Rearing of Silk Worms."

NOTES AND QUERIES.

Manufacture of Size.—Can any of your readers inform me how to manufacture size used for sizing woollen warps, or if there is a treatise on it in any chemical work?—J. MORGAN.

Picric Acid.—Sir,—I can give your correspondent "S. R." all the particulars he wants concerning the manufacture of picric acid. You can give him my name and address, if, at the same time, I have his.—B.Sc.

Platinum Metals.—Sir,—On dissolving some waste shreds of platinum I found that a small quantity was insoluble. It was in fine powder with perfect metallic lustre. Can any of your correspondents kindly inform me what it is likely to be?—C. R. N. B.

Preservation of Crystals.—Sir,—If any brother reader of the CHEMICAL NEWS will inform me of a convenient way to preserve fine crystals of efflorescent substances, and salts which change on exposure to the air, he will confer a favour on—CASSIO.

Tannate of Alumina.—Sir,—Is tannate of alumina formed by adding gall liquor to acetate of alumina, settling and filtering? If your corrrespondent "Effra" wants it for the aniline colours, he will find it to give a good lake by adding the colouring matter to the acet. alumina and precipitating with galls.—C. A.

Dyeing Black.—Sir,—Will you kindly solve me a problem that has troubled me long? Among other things I manufacture inks, and I always find black ink settle a good deal after standing 3 or 4 weeks, in fact, till it is almost clear. One purpose for which I use it is for inking cloth, and I require it to have a thickish body, but not to appear glossy, as when gum is put in, and also to dye cotton in the cloth and appear of a good blue colour. This is my formula:—Bruised galls, 20lbs.; chip logwood, 10lbs.; aqua, 33 galls.; boil 7 hours, strain and add copperas, 4 ozs. to the gallon. Do I put too much iron, or too little, or what is it that causes it to settle? Could you either give me a better formula, or tell me how to improve mine so as to be of a middling thickness and a bluish colour? If you will, I shall ever be thankful to you for so doing.—BICHROME.

Prevention of Dry Rot.—Sir,—As an architect I have felt very much interested in the statement made by Mr. G. Lunge in your paper of the 21st June, as to the use of tank waste for the prevention of dry rot, and should much like to give it a trial. But I do not quite understand from Mr. Lunge's letter as to whether the waste is to be in direct contact with the timber, or whether it is to be spread on the ground *under* it. I should be glad, also, to learn how the waste is to be obtained. He would, perhaps, kindly point out one or more alkali works at the east end or other parts of London.—T. H. L.

Specific Gravity Problem.—Sir,—Your correspondent "C. H. P." before writing of the "radical errors" in the observations of others, should be careful to be accurate in his own communications. He has evidently very confused ideas as to the relations between the weight of water equal in bulk to the weight in water of, and specific gravity of, a substance. I think the subjoined is a somewhat simpler solution of the problem in question than those of "F. J. R. C." and "Lloyd," the discrepancy between the three results being due to the difference in the number of decimal places used, and to error in "Lloyd's" calculation.

Weight of water equal in bulk to compound $= 50 \div 6{\cdot}1 = 8{\cdot}1968$

Weight of water equal in bulk to olivine $= 20 \div 3{\cdot}2 = 6{\cdot}2496$

Subtracting we obtain—

Weight of water equal in bulk to iron $= 1{\cdot}9472$

Specific gravity of iron $= 30 \div 1{\cdot}9472 = 15{\cdot}406$

As this is about double the true sp. gr. of iron, I assume that *Sideros* has, for the sake of simplicity, given a suppositious example.—

HENRY MATTHEWS, F.C.S.

Specific Gravity Problem.—Sir,—The different solutions of the above problem must have puzzled *Sideros* almost as much as the problem itself. In that furnished by "C. H. P." "there is some radical error," he having mistaken the weight of an equal bulk of water for that of the body in water, as will appear on comparing his calculation with that of "F. J. R. C." The discrepancy between "F. J. R. C.'s" result and my own is caused by his disregard of decimals beyond the 1st or 2nd place. The remarks with which "C. H. P." was pleased to preface his solution are, as it happens, quite *apropos*, for 15·1458 is an even more preposterous specific gravity than the one which he gives. I should imagine that *Sideros*' specimen of meteoric iron was composed of about 10 grains of olivine and 40 of pure iron, as those numbers will give a more nearly correct specific gravity (7·87) for the iron.—LLOYD.

Specific Gravity Problem.—Sir,—Only this moment returned from the Continent, I have not seen either of your two last numbers before to-day, and hasten to correct a mistake, doubtless of my own. The sp. gr. of the meteoric iron should have been stated at 4·9, not 6·1. For this I must apologise.—SIDEROS.

Naphtha.—Sir,—The emphatic "no doubt" of your correspondent who replies to the query put in No. 399, is somewhat amusing. The same idea had lurked in my mind for a long time, but I found it wouldn't fit. I can't quote Chaldaic, but we are most distinctly told that naphtali (*not naphthali*) means "my wrestling" (Gen. xxx. 8). This son of Jacob was born at least 350 miles from the Caspian Sea, and it is certainly something new in Scripture history to be told that the tribe inhabited its shores, when it is quite well known their inheritance was much further distant than even this, viz., north and west of the Sea of Galilee! (See Joshua xix. 32-39). I venture to suggest that between the words naphtha and naphtali there is no connection whatever.—W. BRIGGS, Naphtha Distiller.

TO CORRESPONDENTS.

Engineer suggests that some boiler explosions may be caused by the annular discharge of steam, sometimes attracting the safety valves to their seats, and thus obstructing the escape; in the same way that a strong blast of air discharged from a pipe within a short distance of a flat surface, will not repel, but will attract any object placed in the intervening space.

F. H.—The vapour of bisulphide of carbon, constantly inhaled, is said to produce temporary insanity amongst workmen.

B. R., U.S.A.—The metal erbium certainly seems to be an elementary body, and not a mixture of yttrium and didymium. Few chemists have worked on the subject, owing to the rarity of the minerals containing these earthy bases.

Quæsitor asks where stoneware vessels capable of holding 1,000 gallons can be had of the best quality, capable of resisting the action of strong commercial hydrochloric acid at 200 to 300F. He cannot do better than apply to Messrs. Cliff and Co.

Communications have been received from J. Collins (with enclosure); E. Beanes; F. Swan; M. A. Baines (with enclosure); H. W. Kearns, B.Sc.; G. Davies; R. H. Clark (with enclosure); H. Hudleston; W. A. Wood; G. Croome; A. Bird (with enclosure); L. Dourrieu; E. Elliott; J. Ayling; A. Hofmann; E. O. Jones; John M. Swinstead (with enclosure); J. Schad (with enclosure); C. Littleton; S. Highley; C. R. C. Tichborne (with enclosure); F. J. R. Carulla (with enclosure); S. W. Moore (with enclosure); E. James; P. J. Butler; D. Forbes, F.R.S. (with enclosure); J. Landauer; Arthur C. Bowdler; H. R. Marsden (with enclosure); L. Power (with enclosure); C. Crump; R. C. C. Lippincott; J. Sleesor (with enclosure); Dr. C. P. Bahin; W. Briggs; James Smith; John R. Irvine; Peter Squire.

Books Received.—"On the Practice of Employing certain Substitutes for the Genuine Ingredients in some Articles of Daily Food," by a LADY.

THE CHEMICAL NEWS.

VOL. XVI., No. 404.

ANALYSIS OF BLISTER STEEL.

By DAVID FORBES, F.R.S., &c.

VERY few analyses of blister steel are to be met with in any of the treatises on metallurgy, and even in Dr. Percy's recent work on the metallurgy of iron and steel, no analysis is to be found of this truly national product. Under these circumstances therefore, the following analysis of blister steel converted in Sheffield from bar-iron of Swedish manufacture, may be considered as worthy of being recorded.

In making this analysis the portion selected for examination was obtained in a sufficiently divided state by chipping off the bar with a cold chisel, since it was found that no reliance could be placed in filings, which even if produced by the best files were always largely contaminated by the *debris* of the file itself; the determination of the constituents was made as follows:—

Determination of the total amount of Carbon.—77·91 grains of the steel in the form of such chippings, were allowed to remain (about ten days) in a cold solution of 200 grains pure chloride of copper, until no undissolved steel remained behind; the residue was then well washed by decantation, dried, mixed with 100 grains of pure oxide of copper, and burnt in a current of purified dry oxygen gas, at a heat sufficient to soften the Bohemian glass tube. The carbonic acid collected as usual in a potash apparatus, amounted to 2·08 grains, or equivalent to 0·729 per cent carbon in the steel.

Determination of the Sulphur.—107·58 grains were placed in a flask provided with a safety-funnel, and digested (for twenty-four hours) in the cold with strong hydrochloric acid; the gas evolved was passed through a solution of pure chloride of zinc supersaturated with ammonia; the iron being all dissolved, the zinc solution was boiled with nitric acid in some excess, nearly neutralised by ammonia to prevent any solvent action from excess of acid, and precipitated by a solution of pure chloride of barium,—0·04 grains sulphate of barytes were obtained, equivalent to 0·005 per cent sulphur in the steel.

Determination of the Silicon and uncombined Carbon.—The solution from above was evaporated in a water-bath to dryness, re-dissolved in water with some hydrochloric acid, and filtered from the insoluble silica and graphite; these latter were washed off the filter into a silver basin, in which they were boiled with potash, which dissolved out the silica, leaving the graphite, which was collected on a filter, washed, dried, carefully scraped off filter, and after drying at 250° F., weighed 0·11 grains, equivalent to 0·102 per cent uncombined or graphitic carbon. The potash solution of silica was supersaturated with hydrochloric acid, evaporated to dryness, and the residue treated with water rendered acid by hydrochloric acid. The silica was then filtered off and determined as usual, being 0·06 grains, or equivalent to 0·0304 per cent silicon in the steel.

Determination of the Manganese.—The acid filtrate, after separating the graphite and silica by filtration, was now nearly neutralized by ammonia, and then treated with carbonate of barytes in excess, filtered, and the filtrate precipitated by sulphide of ammonium, the sulphide of manganese mixed with some sulphate of barytes was then treated with weak sulphuric acid, filtered, and the manganese precipitated by carbonate of soda as usual, affording 0·18 grains manganosomanganic oxide, or equivalent to 0·12 per cent manganese in the steel.

Search for Phosphorus.—52·75 grains of the steel treated precisely according to Abel's directions (CHEMICAL NEWS, vol. vi. p. 133), afforded no trace of ammonic phosphate of magnesia. 73·28 grains examined by Spiller's process (CHEMICAL NEWS, vol. xiii. p. 170), gave the same negative result; and, lastly, 48·07 grains tested by Eggertz's method by molybdate of ammonia, did not afford any trace of phosphorus.

Determination of Iron.—The amount of iron present was estimated as loss. The percentage results will be as follows:—

Carbon combined	0·627
——— graphitic	0·102
Silicon	0·030
Phosphorus	0·000
Sulphur	0·005
Manganese	0·120
Iron	99·116
	100·000

ON THE USE OF POTASSIC CHLORATE IN QUALITATIVE BLOWPIPE EXPERIMENTS.

By JOHN LANDAUER.

I communicated in No. 399 of the CHEMICAL NEWS, as the result of many experiments, a method of detecting manganese by means of potassic chlorate and the blowpipe.

I have continued these experiments, and convinced myself that this salt may be used with advantage for the detection of many oxides by means of the blowpipe, inasmuch as it leaves nothing to be desired as regards readiness and delicacy of execution. The delicacy of the test especially is greatly augmented by the fact, that the originally white salt assumes the respective colours.

The action of the potassic chlorate is, of course, that of energetic oxidation, caused by the evolution of oxygen at a high temperature. I find it most convenient to employ glass tubes, not too thick, in dimensions of about 15 centimeters long by 5 millimeters in width, and closed at one end; in these is introduced a small quantity of the chlorate, together with the substance to be examined; heat is applied gradually, at last with the help of the blowpipe, until no more oxygen is given off. The reaction is then completed, and the colour of the flux is examined.

I give in the following table some of the more delicate reactions, reserving a more complete investigation, the results of which will shortly be published in this journal:—

Iron	Flesh colour
Lead	Yellowish brown
Copper	Black or greyish black
Cobalt	Blue (in certain cases black)
Manganese	Purple
Nickel	Black (Ni_2O_3).

The Director of the Paris Mint.—M. Dumas, chemist and senator, has been appointed to succeed the late M. Pelouze as Director of the *Commission des Monnaies* of Paris. M. Dumas had previously resigned his appointment of professor in the faculty of science in the University of Paris, and inspector-general of the high schools of France.

ON THE

UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

(Continued from page 96).

Carbolic Acid Colours.

Four or five dyes have already been produced from this compound, namely, *rosolic acid* or *aurine*, *peonine* or *coralline*, *azuline*, and *picric acid*.

Rosolic acid is contained in coal-tar, as was first demonstrated by Runge in 1834, who extracted it from the dark red-brown residual product of carbolic acid by means of spirit; and on treating the solution with caustic lime, he separated a brown compound (brunolate of lime), and obtained a red solution (rosolate of lime), from which he precipitated the rosolic acid as a dark red powder by the aid of acetic acid. Other observers, as M. Tschelnitz in 1857, and Dr. Hugo Müller still later, noticed that the common carbolate of lime of commerce became red on exposure to the air, and that this was due to the formation of rosolate and brunolate of lime; but we are indebted to Dr. Angus Smith, and more recently to M. Jourdan, for an explanation of the changes which thus take place in carbolate of lime, and for suggestions for a process for making the dye on a commercial scale. They found that when the vapour of carbolic acid is passed over a hot mixture of soda and peroxide of manganese, or peroxide of mercury, oxygen is absorbed and rosolic acid produced, thus:—

$$\underbrace{2C_{12}H_6O_2}_{\text{Carbolic acid.}}+O_2=\underbrace{C_{24}H_{12}O_6}_{\text{Rosolic acid.}}$$

The residue yields to water a rich solution of rosolate of soda, from which the rosolic acid can be obtained by precipitating by means of acetic acid.

The production of acid commercially has been accomplished and patented by Messrs. Guinon, Marnas, and Bonnet. They mix together about 23 parts, by weight, of carbolic acid, 10 to 20 of oxalic acid, and from 7 to 14 of commercial sulphuric acid, and heat them for three hours or until the desired colour is obtained. The product is well washed with water to remove the excess of acid, and the residue, which is impure rosolic acid (*aurine*), is a soft pitchy material with a green shade of cantharides; but as the acid is insoluble in water and cannot well be fixed upon fabrics, the patentees have converted it into a new compound, named *peonine*, by incorporating nitrogen with it.

Peonine or *coralline* is produced by heating 1 part of the rosolic acid with 2 parts of ammonia of commerce, for three hours, in a closed metallic vessel at a temperature of 270°. Fahr. The product is a thick liquid of considerable tinctorial power, and which gives with acids a deep red insoluble or fast colour, which may be so applied to silk, wool, and other textile fabrics.

Azuline, as I have already stated, is a blue colour, produced by heating 5 parts of peonine with 6 or 8 of aniline, and keeping them at nearly the boiling-point for several hours.

Picric acid, or *carbazotic acid*, or *trinitrophenic acid*, is obtained by oxidizing carbolic acid with nitric acid. It was formerly procured by a like treatment of indigo and the yellow resin (*Xanthorrhea hastilis*) of Australia, and also by the action of nitric acid upon the coal naphtha which distils between 300° and 400° Fahr.

When carbolic acid is cautiously dropped into strong nitric acid it is attacked with great violence and with a hissing noise, as you may observe; and, according to the strength of the acid, there are produced one or more of the following substitution compounds:—

Carbolic acid	$C_{12}H_6O_2$
Mononitrophenic acid	$C_{12}H_5NO_4O_2$
Binitrophenic acid	$C_{12}H_4(NO_4)_2O_2$
Trinitrophenic acid	$C_{12}H_3(NO_4)_3O_2$

If the acid be strong enough the last compound is alone produced, and when the mixture cools it deposits crystals of picric acid. These are purified by dissolving them in water, neutralising the solution with carbonate of soda, evaporating, and crystallizing. The crystals of the soda salt yield, when they are decomposed with dilute sulphuric acid, fine yellow, pearly looking crystals, or plates of picric acid. They are soluble in from 80 to 90 parts of cold water, and they possess considerable tinctorial power—a grain of acid in 300,000 grains of water will give a moderate shade of yellow to 1000 grains of silk. The colour is best applied with a mordant of alum and cream of tartar; cotton fabrics do not retain the colour, and hence it becomes a test for such tissues when mixed with wool or silk. The solution is very bitter, and, as it is not a poisonous compound, it has been thought that it might be used instead of hops for beer. It forms yellow salts with the alkalies, and with metallic oxides, and most of them are highly fulminating or explosive when heated.

If picric acid is submitted to the action of reducing agents it produces red colours of great beauty; thus *picramic acid* is formed when the acid is reduced by means of a hot solution of protosulphate of iron (Wöhler), or by the aid of sulphuretted hydrogen or sulphide of ammonium (Girard).

$$\underbrace{C_{12}H_3(NO_4)_3O_2}_{\text{Picric acid.}}+6HS=\underbrace{C_{12}H_5(NO_4)_2NO_2}_{\text{Picramic acid.}}+4HO+S_6$$

The acid thus obtained is in the form of brilliant ruby-red crystals, which are soluble in alcohol and ether, and slightly soluble in water.

Isopurpuric acid is another red product of picric acid. It is procured from it by the process of M. Hlasiwetz, which consists in dissolving 2 parts of cyanide of potassium in 4 of water, and when it is heated to a temperature of 140° Fahr., adding little by little a solution of 1 part of picric acid in 9 of water. The liquid evolves ammonia and prussic acid, and, on cooling, deposits an abundant crop of crystals. These are washed with a little cold water, and then dissolved in boiling water to which a little carbonate of soda has been added; as the solution cools it yields tolerably pure crystals of isopurpurate of potash. They have a red-brown colour by transmitted light, and a green metallic by reflected. By substituting ammonia for potash, as by dissolving the crystals in boiling water and adding sal-ammoniac, there are formed, as the solution cools, beautiful red crystals of isopurpurate of ammonia, which is isomeric with the brilliant red dye called *murexide*, and which, but for the cheaper forms of aniline colours, would have been an important dye; for it gives to silk and wool, when mordanted with corrosive sublimate, a magnificent purple rivalling the purple of Tyre; and with a mordant of zinc it produces a brilliant yellow. The colours are very fast, but they will not resist the action of the sulphurous acid so constantly found in the atmosphere of towns.

We know but little of the homologues of carbolic acid—namely, cresylic acid ($C_{14}H_8O_2$)—and the higher members of the series, which may, perhaps, be capable of yielding corresponding coloured compounds.

Naphthaline Colours

have not yet been successfully produced, although many attempts have been made to utilize it in this way; indeed, as far back as 1858, Strecker drew attention to the similitude of chloroxynaphthalic acid and the red colouring constituent of madder (alizarine), there being required only the substitution of hydrogen for the chlorine to change it into madder red; and in 1861, M. Z. Roussin announced that he had actually converted naphthalin

into alizarine. His process was first to act on naphthaline with nitric acid, and so change it into binitronaphthaline, thus :—

$$\underbrace{C_{20}H_8}_{\text{Naphthaline.}} + 2HNO_6 = \underbrace{C_{20}H_6(NO_4)_2}_{\text{Binitronaphthaline.}} + 4HO$$

This is a crystalline body, which he next dissolved, little by little, in concentrated sulphuric acid. The mixture was then heated to a temperature of 392° Fahr., and small portions of granulated zinc were cautiously added to it. After a time sulphurous acid began to be evolved, and the nitronaphthaline was slowly converted into a red colouring matter, which he thought was alizarine. The change appeared to be as follows :—

$$\underbrace{C_{20}H_6(NO_4)_2}_{\text{Binitronaphthaline.}} + H_8 = \underbrace{C_{20}H_6O_6}_{\text{Alizarine.}} + 2NH_3 + 2HO$$

By diluting the mixture with 8 or 10 times its bulk of boiling water, and quickly filtering, the solution yielded as it cooled, brilliant red crystals. But they differ from alizarine in many essential particulars, especially in not giving the purple and chocolate tints, as alizarine does, with iron and alumina mordants.

Mr. Perkin has also devoted attention to this subject, but his labours have not been very successful.

Naphthalamine is a compound which bears the same relation to naphthaline that aniline does to benzole, and it is made by somewhat similiar transformations. Messrs. Calvert, of the Tower Chemical Works, have produced it very largely, in the hope that, by oxidation in the same way as aniline and toluidine are oxidized, colours might be obtained. In this manner Mr. Brunner produced in Mr. Calvert's laboratory a very fine purple, by heating it with arsenic acid. M. Du Wildes obtained a like result with the nitrates of mercury; and M. Roussin has shown how fabrics may be dyed of a red colour by acting on muriate of naphthalamine with nitrite of potash, and how a violet-red tint may be obtained by heating a mixture of naphthalamine and dry bichloride of mercury in a sealed tube, at a temperature of 356°, for many hours; and by heating a mixture of muriate of naphthalamine and protochloride of tin to a temperature of 472° Fahr. The purple-red colour is in both cases insoluble in water, but soluble in alcohol, and may be thus used as a dye. Messrs. Guinon, Marnas, and Bonnet have also proposed to use it in the place of aniline for the production of a blue colour; but I am not aware that any of these processes have been put into actual practice.

And now in conclusion, as I have been compelled, for want of time, to deal very briefly and generally with this subject, I will merely state that those who are anxious to pursue the matter further will find many memoirs on the subject, to which they may refer with advantage. In this country there have been published the valuable report of Dr. Hofmann, at page 119 of the chemical section of the "Reports of Juries" on the International Exhibition of 1862, and the "Lectures by Dr. Calvert on Coal-Tar Colours, in Relation to Dyeing and Calico Printing;" and on the Continent the following have been published :—

1. "Examen des Matières Colorantes Artificielles dérivées du Goudron de Houille." Par E. Kopp. 1861.
2. "Matières Colorantes dérivées du Goudron de Houille." Par Ad. Wurtz. 1862.
3. "Manufacture and Properties of Aniline Colours, and the Bodies used in their Preparation." By MM. Depouilly Brothers. 1866. CHEMICAL NEWS, vol xiv., pp. 77, 89, 157.)
4. "Technologie des Anilins." "Handbuch der Fabrikation des Anilins, und der von ihm derivirten Farben." M. Reimann. 1866.

In addition to which there are numerous papers on the subject in the scientific journals of the last six years, several of which have appeared, either in full or in abstract, in the *Journal of Gas Lighting*.

ON THE PRACTICAL LOSSES OF SULPHUR, &c., IN THE VITRIOL MANUFACTURE.

By CHARLES R. A. WRIGHT, B.Sc.

The following table, calculated by interpolation from Bineau's results (*Ann. Chem. et Physique*, iii. xxiv. 341), may be useful to manufacturers and others in calculating the value of sulphuric acid of a given density according to Twaddell's hydrometer, at a given temperature.

At 15 deg. Centigr.		Diminution in density for 1 deg. C. above 15 deg. C.	Percentage of SO_4H_2.	Difference for 1 deg. T.	Percentage of SO_3	Difference for 1 deg. T.
Deg. T.	Sp. Gr.					
168·52	1·8426	0·192	100·00	..	81.63	..
168	1·840	0·191	97·00	..	79·18	..
				3·38		2·75
167	1·835	0·190	93·62	..	76·43	
				1·87		1·53
166	1·830	0·189	91·75		74·90	
				1·15		0·94
165	1·825	0·188	90·60		73·96	
				0·94		0·77
164	1·820	0·187	89·66		73·19	
				0·76		0·62
162	1·810	0·186	88·14		71·94	
				0·70		0·57
160	1·800	0·185	86·75		70·81	
				0·63		0·51
157	1·785	0·184	84·89		69.29	
				0·53		0·43
154	1·770	0·183	83·30		67·99	
				0·46		0·37
150	1·750	0·182	81·45		66·49	
				0·44		0·36
145	1·725	0·181	79·25		64·69	
				0·42		0·34
140	1·700	0·180	77·16		62·98	
				0·43		0·35
135	1·675	0·179	75·00		61·22	
				0·42		0·34
130	1·650	0.178	72·92		59·52	
				0·42		0·34
125	1·625	0·176	70·83		57·82	
				0·43		0·35
120	1·600	0·174	68·66		56·06	
				0·42		0·34
115	1·575	0·172	66·58		54·35	
				0·43		0·35
110	1·550	0·170	64·42		52·59	
				0·44		0·37
105	1·525	0·167	62·18		50·75	
				0·46		0·38
100	1·500	0·164	59·89		48·89	
				0·47		0·39
90	1·450	0·160	55·19		45·05	
				0·50		0·41
80	1·400	0·155	50·20		40·98	
				0·53		0·43
70	1·350	0·148	44·89		36·65	
				0·56		0·46
60	1·300	0·140	39·29		32·07	
				0·60		0·49
50	1·250	0·131	33·29		27·17	
				0·61		0·50
40	1·200	0·120	27·23		22·23	
				0·64		0·32
30	1·150	0·100	20·79		16·97	
				0·65		0·53
20	1·100	0·080	14·25		11·63	
				0 67		0·55
10	1·050	·0470	7·50		6·12	

The first column indicates the strength as given by Twaddell's hydrometer at a temperature of 15°C., and the second the corresponding sp. gr.

The third shows the fraction of a degree Twaddell to be added to the observed strength for each degree centigrade that the acid is above 15° C.; or to be subtracted for each degree below 15°C.

The fourth indicates the percentage of SO_4H_2, corresponding to the density at 15° given in the first and second columns; and the fifth, the differences between the numbers in the fourth, used for calculating the amount to be added on for fractions of a degree Twaddell.

The sixth and seventh columns indicate the quantities of SO_3 corresponding to those of SO_4H_2 in the fourth and fifth.

Thus, to find the percentage of SO_4H_2 present in acid in which a hydrometer marks 154°·5 T. at a temperature of 25°C.

154°·5 T. at 25°C. correspond to 154·5 + 10 × 0·183, or 156°·3 T. at 15°C.

Acid at 154° T. at 15° C. contains 83·30 per cent of SO_4H_2
Add on for 2°·3 T.: 2·3 × 0·53 = 1·22 ,, ,,

Percentage required .. 84·52

To find the percentage of SO_3 in acid of 121°·1 T. at 9° C.

121°·1 T. at 9°C. correspond to 121·1−6 × 0·174, or 120°·06 at 15° C.

Acid of 120° T. at 15° C. contains 56·06 per cent of SO_3
Add on for 0°·06: 0·06 × 0·35 = 0·02

Percentage required .. 56·08

As acid of high specific gravity is more likely to conain lead sulphate, as the effect of temperature in altering the density is greater the stronger the acid, and as there is but little difference in density for a considerable difference in per-centage with strong acid, it is evident that the amount of SO_3 or SO_4H_2, can only be approximately determined in strong acid by the aid of the hydrometer; taking also into consideration the fact that glass hydrometers, as usually sold, are rarely correct to within o°·5T., and are frequently more erroneous, it may be pretty safely stated that the value of any acid of above 160°T cannot be estimated at all accurately by the hydrometer.

The amount of acid theoretically obtainable from any given ore is readily calculable by the following simple formulæ:—

From one part of sulphur ore containing x per cent of sulphur there is theoretically obtainable—

(1) of acid containing m per cent of SO_4H_2

$$2{\cdot}5 \times \frac{x}{m} \text{ parts.}$$

(2) ,, ,, n ,, SO_3

$$3{\cdot}0625 \frac{x}{n} \text{ ,,}$$

Thus from a kilogramme of ore at 32 per cent of sulphur there is theoretically obtainable of acid at 135°T. (containing therefore 75·00 per cent of SO_4H_2)

$2{\cdot}5 \times \frac{32}{75}$ kilogrs. = 1·067 kilogrs.

and from a kilogramme of pure sulphur there is obtainable of acid at 154°T. (containing 68 per cent of SO_3)

$3{\cdot}0625 \times \frac{100}{68}$ kilogrs. = 4·504 kilogrs.

Chemical Laboratory- St. Thomas's Hospital, S.

Meetings to be held next week at Dundee.—The annual general meeting of the Ray Society will be held at Dundee (during the meeting of the British Association), on Friday, September 6; the British Pharmaceutical Conference will also hold its usual annual meeting during the Association week.

ON THE ABSORPTION OF GASES BY CHARCOAL.

The following letter from Dr. R. Angus Smith, F.R.S., to Dr. J. P. Joule, F.R.S., has been forwarded to us:—

"My Dear Joule,—You asked me about my experiments on the absorption of gases by charcoal. I certainly seem to delay them, but I have little spare time. In 1848 I illustrated the oxidising power of porous bodies, referring chiefly to sand. In 1862, when speaking of the absorption of gases by charcoal, I ventured to say that the physical and chemical action could not be separated. I have been anxious to obtain more direct evidence.

"I had worked a good deal with the mixed gases, but lately thought it better to return to the simple, although unwilling to question results got by others. Five of these gases have been tried, and they are found to be absorbed by charcoal in whole volumes, and not in fractions of a volume, hydrogen being taken as one. In three cases hydrogen, oxygen, and carbonic acid, the numbers are 1, 7·99 and 22·05, extremely exact volumes, with a relation the same as our ordinary atomic weights. Saussure's numbers treated thus give 5·3 and 20, that for nitrogen being 4·2.

"It is only by taking the average of many experiments that these results have been obtained, but, in doing so, every one has been added without selection. The numbers from which the averages are obtained diverge so much that I suppose others have not thought of obtaining anything definite. This is caused by the difficulty of finding perfectly uniform charcoal.

"I have not found the other numbers to be the same as the equivalents, although still whole. Equivalents promise here to enlarge their bounds. I cannot believe that these numbers can be the results of any accident. They must be distinguished from chemical equivalents by weight.—I am, yours, &c.

"Manchester, June 17th, 1867."

R. Angus Smith.

REPORTS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

MICROSCOPICAL AND NATURAL HISTORY SECTION.

July 18th, 1867.

J. B. Dancer, *F.R.A.S., President of the Section, in the Chair.*

"*Some Further Observations on the Cause of Rotation in the Cells of Vallisneria*," by James G. Lynde, F.G.S., F.R.M.S.

In a paper read by me at a meeting of the Section on the 16th February, 1863, "On the Action of Magenta Dye upon Vegetable Tissue," I described a series of experiments upon cuttings of Vallisneria, made chiefly with a view to ascertain, if possible, the cause of the rotation of the chlorophyl vesicles within the cells.

I then concluded that the rotation was due to the action of cilia on the inner surface of the cell wall, and was confirmed in this opinion not only by the appearance of the luminous stratum or so-called ciliary wave which had been observed by Dr. Branson, Mr. Wenham, and others, but also by the appearance on the cell walls of certain markings revealed by the action of the dye on the suspension of the vital action.

The above experiment was exhibited to the Section, and many of the members present attributed these markings, as I had done, to the presence of cilia.

I have since, from time to time, pursued my experiments on the subject, in the hope that I might be able to

adduce more positive evidence as to the cause of the wave of light on the interior of the cell wall.

After many fruitless experiments I at length determined to try the effect of polarized light, and on the application of it with a ⅛th-inch objective, having an aperture of 130° to 162°, and so arranging Darker's series of selenite plates as to give a dark blue ground, there appeared over the surface of all the cells brilliant gold-coloured scintillations which had all the appearance of cilia in motion.

The portion of leaf under examination exhibited very sluggish circulation, and was therefore in a very favourable state for the observation.

I have since repeated the experiment several times, and have never failed witnessing the same appearance.

Notwithstanding all that I have seen I cannot say that I am convinced the appearances can be attributed to nothing else but cilia; it is possible they may be due to the presence of active corpuscles, as suggested by Mr. Wenham in his paper on the leaf cells of Anacharis alsinastrum published in the *Microscopical Journal* for 1855, which corpuscles may be Vibrionia or Zooglæ, described by Dr. Cohn in his "Researches on the Development of the Microscopic Algæ and Fungi," as representing the developmental condition of a plant, but it is only by further research that this point can be definitely settled.

The result of my observations so far appears to be that in addition to the wave of light already seen, the separate objects causing that wave may now be observed in the manner I describe; what these objects are is still a matter to be determined, but at present I am inclined to believe them to be cilia on the cell wall, while at the same time there are also independent moving corpuscles within the cell; some of these bodies have the appearance of crystals, and in one specimen I observed a great number of starch granules in the cells.

In investigating this subject the smallest step in advance cannot but be deemed of importance, and I trust that in giving the results of my observations as they occur, I may be the means of saving time and trouble to others who may be investigating the same class of objects, and of inducing them to follow up so interesting a subject, as it is only by many and independent observations the truth can be ascertained.

For the information of members I may state in detail the method of observation I have found most successful.

The microscope I made use of is one of Smith and Beck's largest sized binocular, with one of Beck's most recent ⅛th-inch objectives.

The illumination was by means of an Argand gas burner, the light passing into a right-angled prism below the stage in a line with the axis of the object glass.

Immediately beneath the stage was the achromatic condenser, used both with and without the central stop in the diaphragm, the object being seen equally well in both ways with different effects of light.

Below the achromatic condenser was fixed Darker's series of selenites, and below this the polarizing prism, the analysing prism being inserted immediately above the objective.

I made use of the low Huyghenian eye-pieces and used the microscope either as a binocular or single tube, the field being well illuminated in each case.

I need not add that the most careful centering and adjustment are essential.

In preparing the object I made a section of a small portion of the leaf laid on a piece of cork in water under a simple microscope, separating only one layer of cells; I laid this on a slip made of thin covering glass, and over it applied a thin glass cover, a small feeding bottle and thread being made use of to prevent the object being dried by evaporation.

I then covered the stage and object with a piece of black velvet, to prevent interference from other lights in the room.

BRITISH MEDICAL ASSOCIATION,

TWENTY-FIFTH ANNUAL MEETING, 1867, HELD IN DUBLIN.

In a paper entitled, "*Mode of Detecting Impurities in Tetrachloride of Carbon*," read in the Midwifery Section, Dr. Protheroe Smith observed, that previous to the publication of his account of this anæsthetic in the numbers of the *Lancet* of last June, there were few if any pure specimens of the tetrachloride to be obtained. To this circumstance he attributes the contradictory conclusions which in some instances had been arrived at by those who had experimented with the tetrachloride. After studying concisely its physical and chemical properties, Dr. Protheroe Smith remarked that the chief cause of the failures above mentioned were the three following impurities:—

I. *Bisulphide of Carbon.*—This is easily detected by evaporating over a spirit-lamp a portion of the suspected fluid in a deep cup, when, if it contains bisulphide, a slightly bluish flame will appear, whereas if free from this impurity it would be entirely uninflamable.

II. *Free Sulphur.*—Should such exist, after spontaneous evaporation of some of the tetrachloride on a watch-glass, a fine opaque film will remain, which when heated would give off the well-known fumes of sulphurous acid.

III. A peculiar sulphur-compound, which is discovered by dipping in the suspected fluid some clean blotting-paper, which when dry will give a peculiar unpleasant smell of dirty linen.

Dr. Protheroe Smith also exhibited his inhaler. It consists of a graduated glass receiver for the anæsthetic, with a tube in its centre, by which at every inspiration air passes first through the fluid, and then through the sponge, thus becoming so highly charged with its vapour as very rapidly to induce anæsthesia.

This mode of administering anæsthetics effects a salvage of from ¾ to ⅞ of the fluid, so that a drachm may go as far as an ounce when employed as ordinarily on a handkerchief. Dr. Protheroe Smith entered more fully into the comparative merits of tetrachloride of carbon and chloroform in an animated discussion on the action of anæsthetics which took place in the Midwifery Section on Friday afternoon, when Sir James Simpson called upon him to give his experience. Some of the advantages claimed for tetrachloride of carbon were that its administration is rarely followed by sickness or other derangement of health,—that it does not seem to interrupt the natural efforts of labour as often observant with chloroform,—that its effect upon the perceptive faculties very rapidly ceases,—that it can be made at much less cost than any other anæsthetic,—that a smaller quantity suffices for use, and for many other medical reasons which were given.

Dr. Smith's tetrachloride is evidently made by passing the vapour of bisulphide of carbon and chlorine through a red-hot tube. There is no doubt that this compound can be procured very cheaply by this method, and that ultimately it will be used in the arts; much of the so-called tetrachloride, however, now met with is procured by the action of chlorine upon chloroform, and is frequently a mixture of chloroform, other chlorides of carbon, and the tetrachloride.

Sulphurous Acid and Hydric Sulphide.—S. de Luca and T. Waldini. The mutual decomposition of these two bodies is not correctly expressed by the equation:

$$2HS + SO_2 = 2HO + 3S$$

for the formation of pentathionic acid is observed during the reaction, which, however, decomposes again, setting free sulphur. The sulphur, liberated, appears in two modifications, of which one is soluble in carbonic disulphide, the other insoluble.—(*Comptes R.* lxiv. 1200).

FARADAY.

A truly great man is, alas! gone from among us, and a man, moreover, whose place cannot be filled. We have great chemists, and great physicists left, but we have not, and probably never shall again have, a Faraday.

It is not often given to the world to possess a man so nearly without a blemish, either in his morals or his intellect,—it is still less often given to the world to possess a man of whom all men speak well. In this respect Faraday stood absolutely alone. But in how many more respects did he stand alone? A man of humble birth, and of high—the highest—aspirations, he sought no social distinctions: a man born poor, and yet who never coveted riches. He was the only man, we say, who has raised himself to the first rank in science in this country, whose every attribute we may fearlessly hold up as a model to our children! Davy had as great, certainly not a greater genius, but his vast ambition, eternal pining after rank, and his hauteur, made up an *ensemble* which it is not for us to imitate. Wollaston was as great a manipulator, and possibly a greater chemist, but his secretiveness and his coldness forbid us from entertaining even the faintest interest in him as a man. Despite the recent discoveries (?) of our French brethren, we cherish a feeling of veneration akin to awe for Newton, but there is no tinge of affection in our admiration. But Faraday's intellect, while it burnt as brightly as Davy's, was as deep searching as Wollaston's, and as reverent as Newton's, had nothing in it which could repel us, chill us, or forbid our affection.

We will not suppose for a moment that our readers are not to some extent aware of the principal incidents in the career of Faraday, but we cannot, while announcing his death, omit, in a few words, a slight sketch of his history, premising that less of it is known than we could wish; but this defect will soon be remedied, for too much cannot be known about him, and unlike most great men, he will never require a Froude to rehabilitate his name.

Michael Faraday was born in 1791, at Newington, in Surrey. His father was a blacksmith, and we deeply regret that we have no authentic record of his youth until the time he was apprenticed to a book-binder. It is certain, however, that at the time of his apprenticeship he was enthusiastically fond of science, and had even made an electrical machine and other scientific apparatus. The almost incredible skill which he had with his hands, (a skill which is born in a man, and which, in its perfection, cannot be taught), induces us to believe that he would find much less difficulty than most men in acquiring the power of using the *materia technica* of chemistry and physics; and the readiness with which Sir Humphry Davy received him as an assistant into his laboratory, is a pretty strong evidence that at that time he knew enough of chemistry to make himself exceedingly useful.

The turning-point in his career really begins with his construction of the electrical machine and apparatus to which we have alluded. His master happening to point them out to a Mr. Dance, a member of the Royal Institution, that gentleman took him to hear some lectures of Sir Humphry Davy's. The result may easily be guessed. Every one knows that there was an almost magical charm about Davy's lectures. His wonderful discoveries, his enthusiasm, his brilliant experiments, his great reputation—if all these advantages could so enchain his audiences, that the women would fall in love with him, and send him letters, no wonder that the intellect of the noble boy was captivated and fired by them. In the purity and simplicity of his heart he thought that the priests who cherished the sacred fire were free from the meannesses and weaknesses of ordinary men.

Unhappily, scientific men are by no means what young Faraday thought them, and although science proved to him an indulgent mistress, she too often is seen as the stern goddess who can only be propitiated by the sacrifice of life; or, like the dames in the old romances of chivalry, by the performance of labours which tax the strength and courage of her votaries to the very utmost. The whole history of science is the history of a struggle for pre-eminence among its students, who, too often, take more delight in demolishing the reputation of the one man who has raised himself above his fellows, than in assisting the ninety and nine poor students who vainly appeal to them for help. The war between professors is a war to the death, and woe be to the weaker sword; and as the crusaders crammed the true faith down the throats of the unbelievers beneath the banners of the Cross, so professors slaughter each others' reputations in the gentle name of truth. As poor Mulder said of his tormentor, "It is in the name of truth that he plunges his branding iron into the fire, and it is while shouting 'truth' that he presses it on the forehead of his victim, and rejoices in the ascending vapour!"

Faraday, knowing nothing of these things, took copious notes of Sir Humphry's lectures, and forwarded them to him with a letter, in which he stated his anxiety to leave trade, and devote himself to Science, so that he might associate himself with men, who, purified by the grandeur and sacredness of their calling, were free from the littlenesses and weaknesses of other men. Sir Humphry received him kindly, and (no one being better fitted for the task) dispelled his illusions regarding the disinterestedness and simplicity of men of science. He also made him his laboratory assistant, a position for which, perhaps, no man in the world was so well qualified. This was in 1813, and for several years he worked unremittingly for Davy, who does not seem to have regarded him in any other light than as a good assistant, out of whom as much work as possible was to be got, and of whom it was expected that he should never forget the vast difference in their relative positions. Even during their stay at Paris, Davy is said to have been annoyed at the attentions that were shown to Faraday. Still, but for Davy, Faraday's progress would probably have been much slower, and there is little doubt that the prestige of being Davy's assistant was of no small value to him in his career.

What Faraday did it is not possible for us here to recapitulate. He discovered benzol, and determined the composition of naphthalin. The first discovery has led to one of the greatest industrial successes which chemistry has ever achieved, and the study of the second led Laurent to some of the most important theoretical discoveries of the age.

As early as 1820 Faraday discovered the chloride of carbon, and it is to him that we are indebted for the information that the chloride of olefiant gas is formed by the union of equal volumes of its constituents. It must not be forgotten that at the

time of this observation being made, chemists had not their present definite views about combination by volume.

In the year 1821 Faraday made his brilliant discovery of the rotation of a wire carrying an electric current, round a magnetic pole, and *vice versâ*. This cardinal fact excited immense attention, and in addition to inducing him to devote himself for many years to electricity with almost unparalleled success, was the means of causing numerous investigators to pursue the same track. In 1821 he published his brilliant paper on the condensation of the gases, in which he enunciated for the first time, the important axiom (now obvious enough) that gases are, in fact, simply the vapours of volatile liquids. In 1824 he was elected a Fellow of the Royal Society, chiefly, it is said, through the influence of his unwavering friend Richard Phillips, and in spite of the unwillingness of Davy; who, however, did not take any active measures to prevent it, and whose unwillingness appears to have been of a purely passive kind.

In 1827 Faraday published the first edition of his "Chemical Manipulation." This work, which has long been out of print, is a most extraordinary proof of the versatility of the author's chemical knowledge. It shows that there was no branch of chemistry cultivated in his time with which he was not practically familiar. In it we see the key to most of Faraday's success, namely, to omit no precaution. The style in which it is written, although clear, is verbose, and far from elegant. This is the more remarkable, inasmuch as he was almost unrivalled as a lecturer, not only for clearness, but conciseness, and the power of rousing the enthusiasm of his audience.

In 1829 he was appointed Lecturer on Chemistry at the Royal Military Academy, Woolwich; and in 1833, Fullerian Professor of Chemistry in the Royal Institution. In 1839 he published the first of his three volumes of "Experimental Researches in Electricity." The second volume appeared in 1844, and the third in 1855.

In 1846 he received the Rumford medal of the Royal Society, for his discovery of the rotation of the plane of polarisation of light under the influence of magnetism; and in 1847 he announced the magnetic character of oxygen, and the relations towards magnetism of gases generally.

So long ago as 1835 he received, at the recommendation of Lord Melbourne, a pension of £300 a-year from Government.

His scientific titles were almost too numerous to recapitulate. In addition to being a member of all the Academies of Science of any note in Europe, he was a Doctor of Civil Law of Oxford, Knight of the Prussian Order of Merit, of the Italian Order of St. Maurice and Lazarus, Officer of the Legion of Honour, one of the eight Foreign Associates of the Imperial Academy of Sciences of Paris, and an Associate of the Paris Academy of Medicine.

Faraday, in addition to, and beyond all his titles, was a true gentleman. His manners were characterised by an extreme gentleness and tenderness for the feelings of others. No one could write to him for advice or assistance without receiving it, and his advice was sure to be wise and good. He was entirely free from jealousy of the scientific discoveries of others; indeed he delighted in doing justice to the merits of his scientific contemporaries.

It is pleasant to know that in 1858 the Queen gave him a residence in Hampton Court.

It would be ungrateful not to put on record a few of the personal impressions which have stored themselves in our memory, in the course of the many years during which we have had the honour and happiness of knowing Faraday. We have seen him at work, we have attended his lectures, we have asked his advice, we have consulted him in our difficulties, and in every position in which we have known him, he has more, far more, than realized the ideas we had formed of him.

We can speak of him in his capacity as a lecturer with more confidence perhaps than most persons, no matter how often they have heard him, for we have followed him word for word in reporting two of his courses of lectures, viz. those on the "Various Forces of Matter," and also on the "Chemical History of a Candle." His delivery was by no means rapid, and shorthand writers followed him with far more ease than they did most persons. His language was well chosen, and when surrounded by his apparatus, he seemed almost inspired. The most simple experiment in his hands told its tale so well, and, by the manner in which it was done, assumed such marvellous freshness, that we forget that we had performed it hundreds of times ourselves, and gazed upon it as eagerly as the veriest tyro in the theatre.

How valuable this gift of enthusiasm is in a lecturer we need not say; it is, as it were, contagious, and in his case at least the earnest lecturer always secured an attentive, nay, a rapt audience. To see him perform an experiment was in itself a most instructive study. A failure was with him almost a thing unknown. His readiness of resource was wonderful, and if, in the course of an experiment, an unforeseen phase developed itself, if instructive, it was commented on and turned to account as an illustration of those forces, in the delightful study of which he passed his life; if, on the other hand, the experiment took a turn which threatened to defeat the object in view, he was ready in an instant with a remedy.

A most characteristic act of Faraday was that which *Punch* (who can be serious enough at times) illustrated by a cartoon headed "Faraday presenting his card to Father Thames." Faraday, in the course of a trip in one of the London steamboats, made some very important observations on the state of the river, and, in order to acquire a tolerably exact idea of the extent to which it was polluted by solid matter, threw pieces of card into the stream, and noticed at what depth they became invisible, owing to the opacity of the water. The information thus gained formed the nucleus of a letter to *The Times*, which did more to call attention to the dangerously foul state of the river than any number of letters from less gifted and venerated writers.

We have said that no one ever asked the advice of Faraday in vain; and certainly, no more golden words were ever uttered than those in which he told to a young inquirer the secret of his uniform success; "the secret" said he "is comprised in three words—Work, Finish, Publish." It must be confessed that young chemists of the present day follow this advice, carefully omitting the second word.

Faraday was married, but, like Davy, Berzelius, and Wollaston, left no children to inherit his glorious name.

On Sunday last he died, and it will, indeed, be long before we shall look upon his like!

He is to be buried this day. The funeral will leave Hampton Court in time to be at the Royal Institution, Albemarle Street, at 2 o'clock p.m. Thence it will proceed to Highgate Cemetery. His funeral will be private, but let us hope that his country will not fail to erect a monument to his memory, worthy of his genius.

We have no Public Laboratory in this country, as they have in France, where really deserving students may carry out their researches at the public cost. What could be a more fitting monument to Faraday than such an institution, bearing his name?

ACADEMY OF SCIENCES.

Aug. 20, 1867.

(From our own Correspondent.)

Shooting Stars.—Animal Electricity.—The Pascal-Newton Forgeries.—Photographic Registration of the Beatings of the Heart.

The correspondence was without interest.

M. Coste presented, on the part of MM. Coulvier-Gravier and Chapelas, the result of their observations on the shooting stars during the nights of the 9th, 10th, and 11th of August of this year. They showed, by a tabular statement, that from the 5th of August, the mean hourly number at midnight on a clear sky, that is to say, corrected for the lunar light and the presence of clouds, was 16·2 stars; this became 33·7 on the 9th, 49·9 on the 10th, and 28·7 on the 11th; giving an average of 37·4. Comparing this with the year 1848, which hadgiven for the mean hourly number, 110 meteors, it is plain that the quantity diminishes very sensibly.

M. Saigey, formerly collaborator of M. Coulvier-Gravier, has just published the results of his meteoric observations made in 1845 and 1849 for all the clear nights.

M. Schultzstein, of Berlin, read a paper on animal electricity, stating that all the phenomena are reduced to simple voltaic currents in which salt acts the part of the electromotor.

M. Chasles took up the discussion relative to Pascal's and Newton's letters. He is astonished that their authenticity has been doubted, inasmuch as they are exchanged berween twelve different persons. The writings of Montesquieu is well-known; and there are letters from Marriotte, whose writing can be compared with that of manuscripts in the library, &c. There are about 500 letters and notes of Pascal, 200 of Newton, and 300 of Labruyère in the possession of Pascal.

M. Le Verrier declared his incompetence as member of the commission to inquire into the documents of M. Chasles, and regretted that he could not assist this gentleman in any way in the absence of proofs; and in polite terms demanded the usual proofs of authenticity required by astronomers, so that that they could judge when they received them.

M. Chasles replied in warm terms, and a rather stormy discussion ensued. He said that the number and nature of the documents communicated ought to satisfy all doubts relative to their authenticity! He added that he was going to publish the most curious letters,—for example, those of Molière to Rotrou, and Rotrou to Pocquelin, poetry, unpublished, and other pieces by Rotrou, also letters, &c., from Corneille to Rotrou.

M. Chevreul stated to M. Le Verrier his acknowledgment of the inutility of a commission appointed with too much precipitation.

M. De Landolle proposed in the name of several foreign botanists a change in the nomenclature of botanical classification.

M. Ozonam presented a note on an apparatus by which the beatings of the heart are registered and photographed. They are made to act on the surface of a bent tube containing mercury, the fluctuations of which are noted in the same manner as those of the thermometer and barometer are photographed. He exhibited several curves obtained by this means, and some magnified by the megascope.

Carbonic Disulphide, Hydrate of.—E. Duclaux. When carbonic disulphide is rapidly volatilised, a white crystalline mass is formed which is a hydrate of carbonic disulphide. The crystals are very unstable, they decompose at −30°; their composition is $2CS_2+H_2O$.—(*Comptes R.* lxiv. 1099.)

CORRESPONDENCE.

TECHNICAL EDUCATION.

To the Editor of the Chemical News.

Sir,—Having just returned from a fortnight's study of the Paris Exhibition, I read the paper on "Technical Education" in your last number with very great interest, and it induces me to offer a few suggestions, more especially in connection with the scientific training of the artizan class.

The advantages of such a training to those who are engaged in the mechanical and manufacturing industry of the country are so generally admitted, that it would be unwise, not to say positively injurious, to make any distinction in this respect between the employer and the workman. The latter, from the very nature of things, is often more likely to suggest improvements in processes which the former would overlook. Hence the value of a scientific training for the one is, at any rate, quite as important as it is for the other.

Assuming that our alleged inferiority in the present Exhibition is owing to the want of technical education, one is naturally led to inquire into the operations of the Science and Art Department—a branch of the Government recently created for the special purpose of promoting the scientific education of the people.

As far as my own experience goes, I am of opinion that the action of the department is far too limited to render any great service to the country. It serves to ascertain, by means of training and examination, that there is a very considerable amount of latent talent in the country, but takes no further steps to turn this talent to account. So far as the adult artizan is concerned, I know not that any more can be done than to put him in the way of applying the scientific knowledge he has gained to the more intelligent performance of his work. But with regard to the sons of artizans, who pass through this preliminary course with credit, and who give evidence of superior talents, is it right, or even expedient, to allow these talents to fall into decay for want of a higher culture?

Now, if we had possessed in England such schools as the *Ecole Centrale* in Paris, or the *Ecoles des Arts et Métiers* of Châlons, and other places, where youths of all classes are admitted to compete for admission, and, in cases where their parents or relatives are too poor, are provided for, either partly or wholly at the country's expense; I will venture to say that, far from occupying a position of inferiority to other nations in manufacturing industry, we should, with such advantages, have maintained a decided supremacy.—I am, Sir, &c.,

A Teacher of Science.

MISCELLANEOUS.

A Patent for Seeing Ghosts.—The "vital-force" patent on which we commented some little time since, has been out-done by a scheme which has just come across the Atlantic. According to Dr. Van der Weyde, in the *American Journal of Mining*, a spiritualist of New York has lately applied for a patent for an arrangement to make ghosts or spirits visible. It consisted in a room from which light and air was almost excluded, only air was admitted by a stop-cock, which was opened from time to time, and light was passed, in a very small quantity, through a piece of dark-blue or black glass, or fluid, so that when first entering the room nothing was seen, but remaining in it for any length of time a very faint view of the interior was obtained. The inventor asserting that the bodies of ghosts or spirits are so attenuated that common light passes straight through them and makes them invisible.

Pascal and Newton.—The impudent attempt on the part of some French academicians to deprive Newton of the glory of the Law of Gravitation has now been effectually exposed. It will be remembered that when our Paris correspondent alluded to them a fortnight ago, we characterised Pascal's letters as forgeries. It will be seen from the following statement that Newton's letters are also forged. Sir David Brewster writes as follows to the *Athenæum* :—"As the biographer of Sir Isaac Newton, and the only living person who has examined his letters and MSS. in the possession of the Earl of Portsmouth, I feel that I am called upon to expose the forged correspondence between him and Pascal which has recently been presented to the French Academy of Sciences, and published in successive numbers of the *Comptes Rendus*, &c. After perusing this correspondence, I communicated to M. Chevreul, the President of the Academy, the most satisfactory evidence that the letters are forgeries ; but as my letter may not be published till the Committee of the Academy give in their report, I am anxious that the truth, in so far as I can state it, should be known in this country. If the correspondence in question is genuine, Pascal has anticipated Newton in the discovery of the Law of Gravity ; and our French foe across the Channel might justly charge Mr. Conduitt, Bishop Horsley, and myself—who, I believe, are the only persons who had thoroughly examined the papers of Sir Isaac Newton—with having destroyed the letters of Pascal, in order to give to Newton the honour, and to England the glory, of so great a discovery. 1. In the Portsmouth papers there is not a single letter from Pascal to Newton, nor any letter or document in which his name is mentioned. 2. Pascal is alleged to have heard of Newton's *precocious* genius as a mathematician, and to have written to him encouraging letters, when he was only *eleven* years of age! Newton was not a precocious genius. His great powers were very slowly developed. Till he was *sixteen* he was occupied with water- and wind-mills and dials; and, as he himself told Mr. Conduitt, his *first* experiment was made in 1658, when he was *sixteen*—an experiment, too, indicating very little genius. 3. Newton's mother, under the name of *Anne Ayscough*, thanks Pascal for his attention to her son; but *Anne Ayscough* ceased to have that name when Newton was only *four* years old, and had she written after that time it could only have been as *Hannah Smith*. 4. The letters of Newton are signed *I. Newton* and *Isaac Newton*. Newton's letters of correspondence were always signed *Is. Newton ;* the only exception I know being when he signed *Isaac Newton* to a long scientific communication to Boyle. 5. According to the alleged correspondence, Newton received *at least two hundred* manuscripts and notes from Pascal, which he offered to return ; but it does not appear that the offer was accepted. 6. Newton never wrote in French ; his letters to Varignon and other French *savants* were always written in Latin. 7. The letters contain internal evidence that they were not written by Newton. He never could have expressed an *eternal* gratitude for the kindness of his friend. 8. An examination of the handwriting and of the paper by an English expert will, doubtless, add to the evidence given above, that the correspondence in question is not genuine."

Nitroglycerine.—The destruction of the *European* at Colon by an explosion of nitroglycerine, has been the cause of an action at law. The plaintiffs—the West India and Pacific Steamship Company—were the owners of the vessel; the defendants—Guion and another—merchants and forwarding agents. The defendants had received from their correspondents in Hamburg, Messrs. Bandemann, 70 cases of oil, described in the letter of advice as "glonoin oil," and one of 20,000 percussion caps to be forwarded to San Francisco. It appeared that the defendants knew very little concerning the oil they were shipping. Professor Abel, F.R.S., Professor Roscoe, F.R.S.; Colonel Boxer, F.R.S., Superintendent of the Woolwich laboratory, gave evidence as to the nature of the material. By their evidence it was shown to be a highly explosive substance, the explosion being excessively rapid and unaccompanied by smoke, and it is produced by heat. Professor Abel stated that the greater the quantity of oil the lower would be the degree of temperature necessary to explode it, and having in experiments exploded 12 to 20 drops by keeping them for six hours daily at a temperature of 180°, he had arrived at the conclusion that a temperature of 110° to 130° would explode the quantity contained in one of the cases. It appeared that the commercial article, being far from pure, contained a certain quantity of free acid, which generated a gas and produced decomposition, which increased the heat, and the decomposition again was increased with the temperature, and all this tended towards explosion. Moreover, when the compound became saturated with this gas it became increased in bulk, and its pressure against the sides of the case became stronger, rendering it more liable to be exploded by concussion. To the oil and to the operation of these qualities in it they did not hesitate to assign the explosion, and Professor Roscoe stated that one case of this oil exploded would have destroyed the European. Colonel Boxer proved that it was practically impossible to explode a great quantity of percussion caps at once, for, although the explosion of one extended to the few immediately surrounding it, it never went further, and he produced a box of caps upon which he had let a hundredweight fall from a height of 6ft., and it appeared crushed and out of shape, but the caps were unexploded. Moreover, he had put two ounces of gunpowder into the centre of 2,000 caps in a cylinder and placed the whole in a packing-case and exploded, the powder. One-third of the caps only were exploded and the others were untouched. The mode of clearing the composition out of caps, when it is necessary to do so, is by shovelling 20,000 at a time into a heated oven; there is no explosion, and a minute at least elapses before the composition is consumed. The result of all this is that caps will not explode in a body and are not practically dangerous, and in consequence, the practice is to issue all caps from Woolwich, packed in the middle of the package of small ammunition; and no case of accidental explosion has ever occurred. For the defence, it was contended that the explosion might have been caused by torpedoes to be used by Chili against Spain, loaded amongst the cargo without the owners' knowledge The jury found the oil to be the cause of the explosion.

Gun-Cotton Explosion.—Messrs. Prentice and Co. write to explain that the temperature of 170 would have been more correctly written 170°C. (or Centigrade) which is equivalent to about 340°F. (or Fahrenheit), the more usual English scale. This has long been considered the ordinary explosive point of gun-cotton. Since the introduction of the present improved system of washing the material after it has been reduced to a state of pulp, they have not an instance in their experience, extending over several months, where the explosive point has been found to be under 350° Fahrenheit. Without expressing any gratification on such an occasion, they cannot help feeling some satisfaction that such a quantity of gun-cotton, when not closely confined could be exploded without even the fracture of a pane of glass in any of the buildings only ten yards distant, forming on a grand scale an illustration that it is only when subject to a considerable degree of resistance or confinement that the destructive nature of gun-cotton is fully developed. The sporting cartridges made of "safety gun-cotton paper" (of which there were none in this part of the works) may be safely stored in any closet or cupboard, the particular mode of preparation rendering them still less liable to ignition, and harmless unless confined, as in the barrel of a gun.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Bulletin de l'Académie de Belgique. March 2, 1867.

A. KEKULE, "Reports on E. Dubois' Memoir on Monochlorinated Phenic Acid." VAN BENEDEN, "Report on F. Terby's Memoir on the Method pursued by Spiders for connecting Distant Points by a Thread." A. QUETELET, "On the Determination of the Hour at which Falls of Aerolites generally take place." A. KEKULE, "On some Sulphuretted Derivatives of Phenol." "On the Sulphophenic Acids." E. DUBOIS, "On Monochlorinated Phenic Acid." F. TERBY, "On the Method pursued by Spiders for connecting Distant Points by a Thread."

April 6.

Sitzungsberichte der königlich-Bayerischen Akademie der Wissenschaften. (Mathematisch-physikalische Classe.) March 10.

"List of Subjects for Prize Essays for the Year 1868."

SCHONBEIN, "Contributions to the Knowledge of Binoxide of Hydrogen." VON KOBELL, "On Pectolite and Osmelite." A. VOGEL, junr., "On the Variations in the Composition of Water at Different Depths." "On the Estimation of Ammonia." BAUERNFEIND, "On Atmospheric Refraction." "Experiments on Capillary Action at a Low Atmospheric Pressure."

April 21—May 5.

NAGELI, "Experiments on Capillary Action at a low Atmospheric Pressure." "On the Theory of Capillarity."

June 2.

A. VOGEL, junr., "On the Manufacture of Peat Charcoal." SCHONBEIN, "On the Formation of Binoxide of Hydrogen during the Slow Oxidation of Organic Substances."

July 14.

A. VOGEL, junr., "On the Estimation of the Chemical Action of Light by its Influence on Prussian Blue." "On the Volatile Acids contained in Peat, and on the Variation in Quality of Peat from Different Portions of the same Bed."

November 10.

VON PETTENKOFER AND VOIT, "On the Quantity of Carbonic Acid exhaled and Oxygen consumed by the Human Subject during Waking and Sleeping, in Health and Disease." A. VOGEL, junr., "On the Assimilation of Silica by Plants." VON GORUP-BESANEZ, "Researches on Creosote." RECHNAGEL, "On the Expansion of Alcohol by Heat."

December 15.

STEINHEIL, "On a Portable Photographic Apparatus." E. VOIT, "Researches on the Laws of Diffusion of Liquids." SCHONBEIN, "On the Accelerative Action of Fluid Hydrocarbons and other Substances rich in Carburetted Hydrogen on the Oxidation of Absolute Alcohol, and on the Formation of Peroxide of Hydrogen which accompanies such Oxidation."

Sitzungsberichte der Wiener Akademie (Mathematisch-naturwissenschaftliche Classe). October—November, 1866.

A. SCHRAUF, "On the Optical Properties of Crystals and of Allotropic Modifications." "On the Relations between Refractive Equivalents and Specific Volumes." T. PECKOLT, "On the Chemical Composition, Preparation, and Exportation of Guarana or Uarana." L. DITSCHEINER, "On the Theory of Diffraction in Double Refracting Media." T. HEIN, "Analysis of a Meteorite from Dacca, Bengal." R. L. MALY, "On some Derivatives of Thiosinamine." H. HLASIWETZ and A. GRABOWSKI, "On Carminic Acid." G. MALIN, "On a Derivative of Rufigallic Acid." F. ROCHLEDER. "On the Tannin of the Horse Chesnut." L. BARTH, "On Paraoxybenzoic Acid." J. LOSCHMIDT, "On the Theory of Gases."

January, 1867.

H. HLASIWETZ, "On some Tannic Acids." "On the Constituents of Tea." "On the Basicity of Gallic Acid." L. BARTH, "On Protocatechuic Acid." "On the Brominated Derivatives of Gallic Acid, Pyrogallic Acid, and Oxyphenic Acid." E. SCHWARZ, "Analysis of the Mineral Waters of Modling, near Vienna." M. VINGTSCHAU, "On the Action of Physostigmine on the Amphibia." A. SIERSCH, "On the Action of Common Salt on Zinc and Oxide of Zinc." A. BRIO, "On the Optical Properties of Crystals of Hyposulphite of Baryta." A. LIELEGG, "On the Spectrum of the Flame from Bessemer Converters."

Kunst und Gewerbeblatt. April, 1867.

SCHAFHAULT, "On the Cause of the Brittleness of Brass Wire when used for Lightning Conductors." "On the History and Progress of Tanning in Germany." E. DIETRICH, "On Fusel Oil and its Applications." K. SCHLEE, "On the Production of Artificial Meerschaum and Horn from Potatoes, Turnips, and Wood." "On Plastic Wood." "On the Composition and Utilization of the Wash Waters of the Wheat Starch Manufacture." "On Iron Minium as a Paint for Wood and Metal." "Price List of Philosophical Apparatus manufactured by P. Carl, at Munich."

May.

W. VENULETH, "A Press for forming Spent Tan into Cakes for Use as Fuel." E. LANGEN, "On an Arrangement of Apparatus for mechanically emptying the Cooling Cylinders of Retorts for revivifying Animal Charcoal." E. ZIEGLER, "On the Presence of Carbonate of Lime in Brick Clay, on its Influence on the Ware, and on the Methods of preventing its injurious Action." R. LINNER, "On the Use of moveable Tubs as Receptacles for Excrementitious Matters at Gratz."

NOTES AND QUERIES.

Carriage Grease.—Sir,—Can any of your readers kindly supply me with the composition of carriage grease, dry and wet wheel grease. —"GREASE."

Pyroligenous Acid.—Sir,—Will any of your readers inform me of a good method of converting crude pyroligneous acid into pure acetic acid.—W. A. (Mass.).

A New Gas,—Sir,—In the *Transactions* of the Aeronautical Society of Great Britain, page 49, Mr. F. Brearey, speaking of some desiderata in aërial locomotion, said that "if it were possible to discover a non-inflammable gas, the object would be attainable without danger. He mentioned this not without hope, as he had received a letter from a gentleman stating that he had succeeded in manufacturing such a gas, which, although at present expensive, he thought might be considerably reduced in cost, and that it was nearly of the specific gravity of hydrogen." Can any of your readers tell me what gas this can be? I am utterly at a loss to imagine.—SCEPTIC.

Naphtha.—Sir,—On referring to the 1st chapter of the second book of Maccabees, verses 19 to 36, the origin of the word naphtha will, I submit, be plainly seen. In a letter of the Jews from Jerusalem to those of Egypt, they state that when their fathers were led into Persia, the priests "took the fire of the altar privately, and hid it in a hollow place of a pit without water, where they kept it sure, so that the place was unknown to all men." After many years Neemias sent on the matter, when it was told "they found no fire but thick water." This thick water was then drawn up and laid on the sacrifice, and when the time came "that the sun shone, there was a great fire kindled." "When the sacrifice was consumed Neemias commanded the water that was left to be poured on the great stones; when this was done there was kindled a flame." "So when the matter was known it was told the King of Persia that in the place where the priests that were led away had hid the fire there appeared water, and that Neemias had purified the sacrifices therewith; then the King enclosing the place made it holy, after he had tried the matter," "and Neemias called this thing naphthar, which is as much as to say, a cleansing."—W.C.

TO CORRESPONDENTS.

Hugo II.—Pure glycerine is not affected by boiling with nitrate of silver solution; common glycerine frequently contains compounds which possess a rancid odour, and which reduce nitrate of silver.

Puzzled.—Alumina prevents the precipitation of the ammoniomagnesian phosphate under some circumstances. This was pointed out by Herr Knop in our last volume, page 207.

J. Bignel.—Ascertain if the phosphoric acid contains phosphorous acid by adding to a solution of it an aqueous solution of sulphurous acid, and gently heating. If phosphorous acid be present, sulphur will be precipitated; if arsenic be also present, a yellow precipitate of sulphide of arsenic will be formed.

Tyro asks if we can oblige him with the name of a poison which will kill in about three days' time, and with all the symptoms of some known disease. The poison, moreover, must be one which an analytical chemist could not detect. Will our correspondent kindly forward his name and address?

Beak.—The explanation would prove too lengthy for this column. You had better refer to Wurtz's "Introduction to Chemical Philosophy," where the question is fully treated.

A Tyro.—The free library of the Patent Office, Southampton Buildings, Chancery Lane, will be most suitable.

Percolator.—It is the ammonia which chiefly acts. The sulphur combines with hydrogen, and is evolved.

A. Payne.—They are given in full in the *Journal of Gas Lighting*.

R. C. C. L.—The alterations are not important enough to be worth calling attention to.

G. J. de Winton.—The Mille Gazo-lamp is to be obtained of MM. Leplay, Noel & Co., Paris.

Specific Gravity Problem.—Several correspondents are thanked for their communications on this subject. "C. H. P.," and another correspondent, who gives no signature, have each given the right solution, taking Sideros's corrected figures, viz. sp. gr. = 7·587. "H. Catheldron" uses the original data, and brings out the sp. gr. = 15·4104. "Y. O. U" "O Jennings," "John Fordyce," and "J. B. T." give erroneous formulæ. "Hugo Schmidt," "Ed. Moyes," "J. Hazlewood," "W. H. H," and "E. Robinson," send elaborate criticisms on all the published formulæ, and each give correct results, with general methods for solving all such problems. To print these letters would occupy several pages, and as they only give in different language the general formulæ already published, we think little good would be gained by prolonging the discussion.

Communications have been received from D. Forbes, F.R.S.; W. Ainsworth (with enclosure); J. Spiller; C. R. C. Wright, B. Sc.; R. C. C. Lippincott; Dr. Parkes, F.R.S.; G. J. de Winton; W. Huggins, F.R.S.; A Payne; S. Reeve; A. Pritchard (with parcel); H. Woodward; Dr. Adriani; E. Anderson; P. Jestram; J. Foreman; G. Griffith; F. Price (with enclosure); Dr. S. Smith; Edward Burn; Edward Beanes; W. Armstrong; J. Cubitt; (with enclosure); Howards and Sons; S. Rew; Prof. Pepper (with enclosure); Page & Tibbs (with enclosure), R. Alison; J. J. Buchanan; C. Tennant (with enclosure); H. Catheldron; O Jennings; J. Fordyce: Hugo Schmidt; E Moyes; J. Hazlewood; E. Robinson W. A. Townsend (with enclosure).

SUPPLEMENT
TO THE
CHEMICAL NEWS.
Vol. XVI., No. 404.

PHILOSOPHICAL CONCEPTIONS OF CHEMICAL PHENOMENA.

The "fundamental definition" of a chemical phenomenon lately advanced by Sir Benjamin Brodie, to the effect that 'A chemical phenomenon is an operation on the unit of space, the result of which is a weight," has strongly directed the attention of chemists to the primary conceptions on which the philosophy of their science is based.

At such a juncture it cannot but be interesting to set in contrast with the above startling philosophical innovation, one of the most clear and powerful expositions extant of the received mode of viewing this abstruse question.

Such an exposition we find in the ninth chapter of the admirable "Introduction to Modern Chemistry" lately put forth by Professor Hofmann in collaboration with Mr. F. O. Ward,—"whose well-known powers of lucid composition, and habits of philosophical thought, are traceable," as his illustrious colleague justly observed in his preface, "in every chapter of the work."

We shall the more readily lay these extracts before our readers, because, while specially apposite to the present tenour of chemical meditation, their appearance will redeem the promise made by us, in our first review of this book, to give it a second notice in our columns.

We therefore, without further preface or apology, proceed to lay the following extracts before our readers, merely remarking that we have here and there exercised our editorial privilege of excision and abridgment.

"Thus far," say the collaborating authors, "we have not quitted the domain of experience, of observation; to the *causes* of the remarkable phenomenon we have contemplated, our attention has not yet been turned. Yet the inquiry into the causes of observed phenomena is urged on us by one of the strongest instincts of our intellectual nature. That instinctive curiosity cannot, indeed, be fully satisfied. The first causes of phenomena lie beyond the limited scope of our perceptive and reasoning faculties. The conditions of their existence or production, and their relations of succession and similitude are, indeed, open to investigation; but their intimate nature and prime origin are for us inscrutable mysteries. We may, however, by the aid of imagination, form *hypotheses*, to connect the results of our experiments, and to guide the course of our inquiries. And, though merely speculative hypotheses, dissevered from experimental investigation, are to be deprecated as vain and sterile exercises of ingenuity, hypotheses based upon facts, assisting in their conception, and deriving probability from the number thereof which they connect and explain, besides (and above all) tending to suggest new experiments, deserve to rank among the most valuable aids to scientific research.

"Hypotheses are, of course, to be held provisionally, subject to modification and abandonment, in so far as they may from time to time prove inconsistent with the results of further experimental research. On the other hand, when hypotheses embrace and explain extensive ranges of phenomena, when experiment confirms the results they foreshadow, when successive discoveries raise them higher and higher in the scale of probability, they lose more and more their provisional character, and gradually assume the name and rank of *theories*, till at last they come to be embodied among the recognised doctrines of philosophy.

"The observed phenomena of combination in definite proportions by weight and volume, are susceptible of explanation by a theory in the highest degree probable and suggestive, which comes next in order for our consideration.

"In order to arrive at this theoretical conception, we must ask ourselves, what *is* matter? Of what parts is it composed? How are these constructed and held together? How comes the very same matter, water for example, to present itself sometimes in the solid form, as ice; sometimes in the liquid form, as the same ice when melted; sometimes in the gaseous form, as the same melted ice changed to dry steam by further heating? And, lastly, what happens to matter, what changes does it undergo, when its various elementary forms combine, as we have seen them, to produce bodies having properties wholly different from those of their constituents?

"Setting aside the more transcendental speculations of philosophers upon the nature of matter, let us here select for consideration those hypothetical conceptions of its structure which seem best adapted to connect and explain the results of modern research; and which by enabling us to comprehend the phenomena we have already witnessed, may also assist us in shaping the course of our further experimental researches.

"Let us, for this purpose, consider the familiar body, *water*, into the nature of which our experiments have already given us some insight; and let us consider it in its three conditions, as ice, as fluid water, and as water-gas or dry steam. What is the first thing that strikes us in looking at them?

"The first thing that strikes us is, that ice, water, and steam manifest two sorts of activity;—one exerted by masses of sensible magnitude, acting through measurable distances of space; the other operating between particles, and through intervals of of space, so minute as to be incommensurable.

"The attraction of mass for mass of matter, as manifested in the courses of the celestial bodies, in the movement of falling bodies, and in the pressure of bodies at rest upon the ground, exemplifies the first kind of activity. This is equally observable in the ice, in the water, and in the water-gas; for these all possess *weight*; a sensible mass of either reciprocates attraction with the earth, through measurable distances of space.

"The Latin for mass is *moles*; and its modern diminutive, *molecula*, is employed to designate "a little mass," that is to say, a material particle of incommensurable minuteness; hence the reciprocal actions of minute particles through insensible intervals of space are distinguished as *molecular*. We may fairly therefore contradistinguish, by the epithet *molar*, the reciprocal actions of measurable masses through measurable intervals of space.

"The means of mechanical comminution at our disposal, our grinding-mills, mortars, and the like, do not carry us beyond the *molar* subdivision of matter. However finely we might grind up ice, for example, if we took care to keep the temperature below freezing-point, we should still have masses each consisting of several molecules. For, our finest ice-powder would still consist of very small fragments of solid ice; and if, of this ice-dust, we took the smallest grain, we could, by applying heat, turn it into water, thus proving it to have *parts*, capable of separation, so as to be rendered moveable amongst each other. There is no instance of liquefaction resulting from the mechanical comminution of a solid body. Hence we take it as certain that the most impalpable product of mechanical pulverization is still a cluster of molecules.

"We are thus enabled to distinguish in matter two kinds of divisibility, *molar* and *molecular*; the former being accomplished by *mechanical* means, and only resulting, even when pushed to its utmost attainable limits, in the production of a molecule-cluster or mass of sensible dimensions, which may be termed a *mole*; while the

latter is accomplished by *physical* means (that is to say, by the aid of physical forces, such as heat), resulting in the disruption of the masses or *moles* into their incommensurably minute constituents *molecules*.

"The study of the reciprocal action of material *masses*, or *moles*, constitutes the science of *mechanics*; a science of the deepest interest, abounding in simple and admirable laws, with which, however, we are not at present concerned.

"Turning to the consideration of *molecular* activities, of those which are distinguished by the incommensurable minuteness of the particles of matter, and of the intervals of space, between and through which they take place; and looking once more at the samples of matter before us—at our ice, our water, and our water-gas or steam; we are again, as before, struck with a contrast between two diametrically opposite kinds of activity, one conspicuously manifested in the solid ice, and called *molecular cohesion*, the other especially manifested in the water-gas, and termed *molecular repulsion*. The former force gives to solid bodies their tenacity; to the latter, gaseous bodies owe their extreme tenuity, and the free mobility of their molecules amongst each other."

"In fluid bodies, here represented by our water, we observe these two forms of molecular activity balanced at an intermediate point. The molecules of fluids cohere with considerable force; as we perceive, when a rod is dipped into water, and a bunch of them taken out, sticking to each other, and also to the rod, in the form of a pendent water-drop; but this cohesion is exceedingly feeble as compared with that of the same molecules agglomerated in the solid form in a block of ice. Again, the molecules of fluids are moveable amongst each other; as we notice when water is shaken in a vessel, agitated with a rod, or poured into another glass; but their mobility is far inferior to that of the molecules of gas. In vain should we dip our rod into the gas to take up a drop of it; we should obtain no coherent bunch of gas-molecules, like the pendulous water-drop. And it is precisely to their superior molecular cohesion that fluids owe their inferior molecular mobility as compared with gases.

"This difference of comportment is not surprising when we reflect how much greater are the intervals which separate the molecules of a gas—of our water-gas, for example—than those which intervene between the molecules of the same body in the form of ice or of water."

"What is the nature of the intervals between the molecules of a gas?—are they empty space, or are they filled? and, if so, how, or with what are they filled? That they are not empty spaces we have very good reason to believe, on account of the powerful resilient property manifested by gases when forcibly compressed.

"But what is the nature of this elasticity or resilience—to what power or force is it due?

"Several phenomena point to *heat* as its cause. Heat is the agent by which ice is made to pass, through the fluid, into the gaseous form; and, with every increment of heat, the elastic power of the ice-derived gas augments.

"To the questions, therefore, what is a gas? and with what are the intervals between its molecules filled? succeeds the question, what is heat? This brings us face to face with one of the most ardently-mooted and deeply-interesting philosophical questions of the day. For some, heat is a species of thin ether, vibrating in the manner of light; for others, it is a pure force, having neither parts nor weight; for a third class of thinkers, of late years the majority, heat has no separate existence, but is merely a mode of motion, the result of the vibration of material molecules.

"It is no part of our present task to attempt the solution of this deep and difficult problem. We may content ourselves here with the conception that heat, whatever may be its intimate nature, so operates, when it becomes latent in a gas, as to surround each molecule with a sort of repellent atmosphere which tends to keep it apart from its fellows; and that these molecular force-spheres — or, to employ the Greek equivalent, *dynami-spheres*, more shortly, *dynaspheres*, when mechanically compressed, counteract the pressure with exactly equal energy, and on the removal of the pressure, restore the gas (other things being equal) to the exact volume it previously possessed.

"It thus stands clearly demonstrated that, if equal volumes of the elementary gas, hydrogen, and of the compound gas, hydrochloric acid, be taken under any given pressure, and the pressure be doubled for each, each becomes reduced to half its former volume, and at the same time acquires double its former resilient force, or elasticity; which it exerts in counterbalancing the pressure from without.

"It stands equally proved that, if equal volumes of hydrogen, and of hydrochloric acid gas, taken at equal degrees of pressure and temperature, be exposed to equal increments or decrements of heat, they undergo equal degrees of expansion and contraction.

"It has been experimentally established as a law, that all true gases, simple as well as compound, comport themselves in sensibly the same manner under like variations of temperature and pressure; whence the inference fairly follows that their molecular structure is the same. Assuming, then, each gaseous molecule to be clothed or enveloped by a resilient dynasphere (as we have termed it), due, in some unknown way, to the influence of latent heat, experiment justifies us in inferring, from the identical comportment of all gases, when exposed to like variations of temperature and pressure, that they all contain, in equal volumes, an equal number of molecules so clothed; and that, as an obvious corollary, the diameter of these gas-molecules (including in that term as well the dynaspheres as their material nuclei) is,under like physical conditions, precisely the same for all gases. To express it more shortly, our unit-volume, or litre, whether of hydrogen, of hydrochloric acid, or of any other gas, simple or compound, is composed of mutually repellent dynaspheric molecules, equal (*omnibus paribus*) as to their *number*, and (consequently) as to their *size*.

"At this point of the inquiry we may advantageously resume the consideration of material divisibility, of which we have already studied two forms or grades, the *molar* and the *molecular*; the former consisting in the mechanical disruption of large masses into small ones, the smallest still possessing sensible magnitude; while the latter is the further disruption, by physical agents, such as heat, of moles or masses, whether large or small, into their constituent molecules; that is to say, into parts contra-distinguished from the minutest moles by the fact that they (the said parts) possess no commensurable magnitude at all. In the particular sample of matter which we have selected for study, as being the most familiar of all compounds, we see molecular succeeding to mere molar division, when heat melts comminuted ice into water,and then raises water into invisible steam or gas, by clothing its molecules with the mutually repellent dynaspheres, each dynasphere 1689 times larger than its material nucleus.

"Infinitesimal as this subdivision of matter appears,—inexpressibly minute as we cannot but conceive the material particles to be that form the central nuclei of the dynaspheres of bodies so attenuated and rare as the invisible gases,—we yet know, by experimental proof, that a further comminution of matter is possible; and that, as the smallest mass or mole of any compound may be broken up into its constituent molecules, immeasurably smaller still, so the ultimate molecule itself, however small we may choose to conceive it, is nevertheless still a *compound*, consisting of at least two parts, which, by chemical agency, may be detached from each other, so as to resolve the compound into its elements.

"Here the divisibility of matter, so far as our experimental knowledge extends, reaches its final term. The *elementary* bodies are, as we remember, so called pre-

cisely because they resist every agency, mechanical, physical, and chemical, which we can bring to bear in the hope of dividing or decomposing them. We may imagine the two elementary particles which form the compound molecule of hydrochloric acid, for example, to be as small as we please. In this respect we may give the imagination free rein; we may conceive the particle of hydrogen, or of chlorine, to be divided and subdivided as many millions of times as we like,—or rather, until the imaginative power is baffled by sheer exhaustion in the endeavour to push this conception further. No experiment yet made tends to restrict the freest range of our mental faculties in this direction; their only limitation lies in their own finite scope, doubtless more or less extensive in different minds. But, when we have, each of us, thus reached the idea of the smallest elementary particle which it is within the power of the mind to picture, all experience stands opposed to our going still further, and presuming to declare the elementary particles capable of division *ad infinitum*. Not one experimental result can be adduced in support of such an assertion. At this point, therefore, the experimental philosopher arrests his inquiry. Beyond this limit he sees only the dream-land of metaphysical speculation—a region essentially sterile because shut out from cultivation by means of experiment, from which alone can spring the harvest of Truth in the proper sense of the word; having for its foundation natural facts; for its object the study of their relations; for its result the determination of their laws.

"To the metaphysical speculators, therefore, let us cheerfully resign the utter futile and fruitless discussion whether even elementary matter may not be infinitely divisible. It is enough for us to know that, at all events, *we* cannot infinitely divide it, but that, relatively to our powers and purposes, to the limits of our imagination as well as of our experience, the assertion of the infinite divisibility of the elements is one we are not justified in making.

"We thus arrive at the conception of indivisible particles as the ultimate constituents of elementary bodies, and these particles have received the appropriate name of *atoms* (from the Greek word *τέμνω, I cut, I divide*, with the privative *a* prefixed in token of negation).

"The addition of this final term completes and enables us to epitomise our view of the threefold divisibility of matter, molar, molecular, and atomic; the first (molar) being performed by *mechanical* means, and resulting, when pushed to its utmost limits, in masses or moles (clusters of molecules) characterised by their possession of sensible magnitude; the second (molecular) accomplished by the agency of the physical forces (heat, electricity, &c.), employed under special conditions for the purpose, and resulting in the production of the dynaspheric *molecules* of which we reasonably conceive compound bodies to consist; the third (atomic) being capable of accomplishment only by agencies, such, and so applied, as to produce *chemical* decomposition, breaking up the incommensurable molecule itself into its elementary particles, which (as just explained) are called *atoms*, because incapable of further disruption or comminution by any means at our disposal.

"This conception of the threefold divisibility of matter, molar, molecular, and atomic, being once clearly understood, and firmly grasped by the mind, we may usefully proceed, in the light which this theory supplies, to compare as to their structure compound with elementary gases. At first view we should be disposed, perhaps, to anticipate as probable, that, while the compound gases would be formed of divisible molecules or atom-clusters, the elementary gases would present no such complexity of structure, but consist merely of separate and indivisible elementary particles. But a little consideration will show us that this view is incompatible with the results of our preceding inquiry.

"Let us, to simplify our calculations, assign to the unknown number *n* of HCl molecules, existing in our bilitral volume of hydrochloric acid gas, some definite numerical value, say 1000.

"This being assumed as the number of molecules in 2 litres, the number in 1 litre is of course just half, or 500; and, as we recognise that equal volumes of all gases contain equal numbers of molecules, the litre of hydrogen and the litre of chlorine, which go to the formation of our 2 litres of hydrochloric acid gas, must likewise contain 500 molecules each.

"Now, as each molecule of hydrochloric acid contains 1 atom of hydrogen joined to 1 atom of chlorine, the 1000 molecules of hydrochloric acid must, of necessity, contain 1000 atoms of hydrogen joined to 1000 atoms of chlorine — the whole number of atoms present being therefore 2000.

"But we have just seen that one litre of hydrogen and one litre of chlorine contain, not 1000 molecules each of the respective bodies, but only 500.

"It follows clearly that 500 *molecules* of hydrogen and 500 *molecules* of chlorine have supplied respectively twice as many *atoms* of those constituent bodies; each contributing its 1000 atoms to the aggregate number of 2000 atoms, existing in the 1000 HCl molecules, contained in our 2 litres of hydrochloric acid gas.

"If 500 molecules of an elementary gas supply 1000 atoms it is plain that each molecule supplies 2 atoms; and thus we clearly perceive that the molecule of the compound gas under review, and the molecules of each of its elementary constituents, are all formed on the same type—that type being the first of our quadruple series, viz., the hydrochloric acid or *diatomic* type.

"This is a remarkable and striking, yet strictly logical deduction. It completes a chain of reasonings which, if correct, justify the conception that simple as well as compound gases are complex as to their molecular structure; and that this structure, for all the permanent elementary gases, is of the diatomic type."

THE CHEMISTRY OF METEORITES.

By W. WARINGTON SMYTH, M.A., F.R.S.

M. Daubrée, already so distinguished for his researches on metamorphism, has recently published the results of his Synthetical Experiments on Meteorites, and has thus brought before us, from an entirely different point of view, an inquiry into the nature and origin of the silicated magnesian rocks and minerals.

M. Daubrée first describes his experiments on *the imitation of the meteoric irons*. The most characteristic feature of these masses is the crystalline pattern (Widmanstätten's figures) which is brought to view on a polished surface by the action of an acid. Simple fusion of the meteorite of Caille (Var) in a *brasque* of alumina (to avoid the contact of carbon, which would have combined with the iron), was insufficient to reproduce the appearance, although the resulting substance was certainly crystalline. Further experiments, in which soft iron was associated with some of the other substances that commonly accompany meteoric iron, such as nickel and protosulphide of iron and silicon, yielded a highly crystalline result, but not yet of the true character. If, however, to the soft iron was added phosphide of iron, in the proportion of from two to five or ten per cent, and, still better, if there was introduced at the same time nickel, and if a mass of as much as two kilogrammes in weight was operated on, there appeared, when the cooled lump was polished and etched, in the midst of dendritic patterns of great regularity, lines of a brilliant material dispersed in a reticulated form.

A third mode of attempting the imitation was that of melting down certain terrestrial rock-substances, as peridote, lherzolite*, hypersthene, basalts, and melaphyres. By this means specimens of iron were obtained which, both in composition and structure, bore strong

* Lherzolite (so called from Lherz, in the Pyrenees) is a rock composed of peridote, enstatite, and pyroxene (augite).

resemblance to many of the siderolites. Especially was this notable in the metal obtained from the lherzolite of Prades (Eastern Pryenees). These artificial irons were then found, like the natural meteoric ones, to contain nickel, chromium, and phosphide of iron, the latter in long needles recalling the appearance of the natural patterns.

Imitation of the Meteoric Stones.—Contrary to what might have been expected from the appearance of the black vitrified crust on the surface, the substance produced by the melting down of meteorites obtained from above thirty different falls, was in every case highly crystalline. Those of the common type present a group of metallic granules, disseminated in a stony mixture of peridote ($\dot{M}g_2\dot{S}i$) and enstatite ($\dot{M}g\dot{S}i$), the former generally on the surface as a thin crystalline pellicle, the latter in the interior as long acicular crystals. A notable contrast was yielded by the aluminous meteorites, such as those of Juvinas, Jonzac, and Stannern, which produced, instead of crystalline, a vitreous mass.

But perhaps the more remarkable results were those obtained synthetically by melting down pieces of rock characterised by the minerals peridote and enstatite. For this purpose peridote (olivine), from the basalt of Langeac (Haute Loire), and lherzolite, from Vicdessos and Prades, were fused in earthen crucibles. They melted easily and yielded crystalline substances, the latter especially closely resembling the original rock. The proportion of enstatite (the bisilicate of magnesia) was found to be increased by the addition of silica.

When similar mineral substances were melted in presence of a reducing agent, the iron (which in the other case remained combined in the silicate) segregated itself in grains of various sizes, separable by the magnet. Thus a perfect analogy was established between the above rocks and the meteorites, as well in their stony minerals as in the iron, which always contained nickel.

Furthermore, some remarkable characters in the structure of the stony meteorites were found to have been imitated, especially the delicate parallel lines attibutable to cleavage, which are visible when a thin slice is examined under the microscope, and the globular structure where the little spherules are sometimes smooth at the surface, at others drusy, or roughened with the points of minute projecting crystals, like the meteorite of Sigena, November 17,1773.

When hydrogen was employed as the reducing agent, the results were very similar, and the reaction would take place at a temperature not exceeding red heat.

Again, another method of imitation, the reverse of the foregoing, was by oxidation. From silicide of iron, heated in a *brasque* of magnesia by the gas blowpipe, a substance was obtained extremely similar to the common type of meteorite. The iron was separated partly as native iron, partly as a silicate, forming peridote, some of it in the crystallized state. Further details of resemblance were attained by heating a mixture of silica, magnesia, and nickeliferous iron, phosphide and sulphide of iron. The stony gangue of the melted product was found to be free from the latter three substances; and instead of the simple phosphide introduced in the experiment, there was observable the triple phosphide of iron, nickel, and magnesium, first noticed by Berzelius in meteoric irons.

The preceding experiments suggest some important deductions on the condition of the planetary matter from which the meteorites have been diverted to our own globe. M. Daubrée makes no attempt to enter the lists with Von Haidinger†, Baron Reichenbach, Prof. Lawrence Smith, and others, on the questions attending the entry of these bodies into our atmosphere, and the circumstances of their fall; but, considering that their surface alone is modified by these conditions, he infers that their interior mass remains the same as when it was wandering in space, and may to a great extent be taken as a sample of the material of the planetary bodies of which they are the fragments.

Seeing how nearly the composition and structure of the meteorites are reproduced by the two methods of experiment, M. Daubrée refers by their aid to the original mode of formation of the bodies from which these meteorites come.

If they were produced from silicated minerals by reduction, in which carbon was the reducing agent, it may be objected that the iron could scarcely have remained in the metallic state; and if hydrogen be supposed to have been the reducing agent, water ought to have been formed at the surface, whence it appears more simple and reasonable to recur to the idea of an oxidizing process. Allow that silicon and the metals existed at one time in the meteorites, not combined with oxygen as they now mostly are, and this by reason either of too high a temperature to allow them to remain in combination, or of too great a separation of their particles, then, as soon as, by their cooling down or by their condensation, the oxygen was able to act upon the other elements, it would at once combine freely with those for which it had most affinity, and if not sufficient in quantity to oxidize the whole, or not enabled to act long enough, would leave a metallic residue. In fact there would be produced the silicate of magnesia and iron, peridote or olivine, and granular portions of nickeliferous iron and of sulphides and phosphides of iron. These views, whilst applicable to a large proportion of the meteoric bodies, would require modifications for those rarer varieties which consist essentially of pyroxene and anorthite. Whilst the magnesian silicates crystallise so readily after simple fusion, these latter substances would only melt to vitreous and amorphous masses, and in order to become crystalline would have needed the presence of water.—*Address to the Geological Society. Anniversary meeting*, 1867.

† See Haidinger, *Phil. Mag.* November and December, 1861.

Sulphate of Alumina.—*Potash alum* is composed of

$$KO,SO_3,Al_2O_3,3SO_3+24HO=474,5.$$

Ammoniacal alum, the most generally used in Paris,

$$NH_4O,SO_3,Al_2O_3,3SO_3+24HO=381,4.$$

Simple Sulphate of Alumina,

$$Al_2O_3,3SO_3+24HO=315,4.$$

Every 100 kilogr. of these three products contains the following proportion of sesquioxide of aluminium.

For 100 kilo. potash alum .. .. 10·820 kilo. of Al_2O_3
" " Ammoniacal ditto. .. 13·460 " "
" " Sulphate Alumina .. 16·270 " "

Thus, it is easy to find the real value of the simple sulphate alumina, the more so as that which constitutes the real value of alum, is not the potash or the ammonia, but only the alumina. It is the alumina that the dyer wants to fix his colours in a state of lacker; the tanner wants the alumina to preserve his hides, and make them fit for gloves and shoes; again, the paper-maker requires the alumina to make his pulp fit for writing on, that is to say, that paper which contains a resinate of alumina obtained from the double decomposition of sulphate alumina with a solution of resin in caustic soda,—this paper, we say, can take writing without fear of the ink running. If the alumina in these salts is the only part useful in commerce, one ought to look for a product which to a given weight shall contain the largest quantity of this alumina. Preference should be given to sulphate alumina, which contains 16 per cent useful product, whilst potash alum only contains 10·1 per cent.—*Moniteur Scientifique*, vol. ix., p. 574.

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THE CHEMICAL NEWS.

Vol. XVI., No. 405.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

DUNDEE MEETING, 1867.

(From our Special Correspondent.)

Dundee, Sept. 5, 1867.

In spite of the great distance from London, and the depressing influence exerted by the parsimony of the railway companies, the present meeting promises to rival any of the previous northern gatherings, excepting, perhaps, the Newcastle meeting in 1863, at which the total number of attendants amounted to 3,335. At the time I write they are nearly equal to the total of the Nottingham meeting—2,300, and new arrivals are coming, both by rail and boat The exigencies of the Post Office allow me only a very limited time to furnish this preliminary letter, so that if my narrative is imperfect in any material sense, I will communicate by telegraph, and the facts may then be interpolated by you. The lodging accommodation in the town seems as yet in excess of the demand, and the prices first quoted are being reduced. Probably this may be accounted for by the fact that a large proportion of the tickets issued has been purchased by residents in Dundee and the neighbourhood. The General Committee met yesterday, at the Panmure Street Chapel, at 1 p.m.

Professor Hirst, one of the General Secretaries, read the report of the Council for the year 1866-7.

Mr. W. Spottiswoode then read the report by the treasurer, which was also agreed to.

Mr. Griffith, Assistant General Secretary, read the report by the Parliamentary Committee.

REPORT OF THE KEW COMMITTEE.

Mr. J. P. Gassiot read the report of the Kew Committee.

The Assistant General Secretary then read the report of the committee appointed by the Council of the Association to consider the best means for promoting scientific education in schools. The report, after pointing out that there is already a general recognition of science as an element in liberal education, and stating that general education in schools ought to include some training in science, went on to refer to the difficulties in the way of introducing science into schools, which the committee, however, considered easily surmountable. With a view to the furtherance of the scheme, the committee made the following suggestions:—

1. That in all schools natural science be one of the subjects to be taught, and that in every public school at least one natural science master be appointed for that purpose.

2. That at least three hours a week be devoted to such scientific instruction.

3. That natural science should be placed on an equal footing with mathematics and modern languages in effecting promotions, and in winning honours and prizes.

4. That some knowledge of arithmetic should be required for admission into all public schools.

5. That the universities and colleges be invited to assist in the introduction of scientific education by making natural science a subject of examination, either at matriculation, or at an early period of a university career.

6. That the importance of appointing lecturers in science, and offering entrance scholarships, exhibitions, and fellowships for the encouragement of scientific attainments, be represented to the authorities of the colleges.

In the afternoon the grand floral fête in Baxter Park was opened under very favourable circumstances as to weather; this is considered to be the largest and finest floral and horticultural show ever held north of the Tay. It was again open this morning to private inspection of the members of the Association.

Yesterday evening the first great meeting took place in the Kinnaird Hall, the company being but little assisted on their way to the assembly by the electric light, which was exhibited in front of the High School, under the charge of Mr. Louis Schwendler. At eight o'clock Sir Roderick I. Murchison, F.R.S., acting for Mr. Grove, who was prevented by illness from attending, in a short speech formally vacated the chair to his Grace the Duke of Buccleuch, the President of this year.

The large meeting-hall was crowded in every part, and confusion had been as much as possible avoided by numbering each seat, and not admitting members or associates unless they had previously got their tickets stamped with a similar number. Your correspondent, who was not aware of this judicious regulation till the last moment, would have had a poor chance of hearing the forcible speech of the noble president, were it not that a General Committee ticket carried with it the privilege of admission to the platform.

Sir Roderick Murchison, in introducing the Duke of Buccleuch, expressed regret at the unavoidable absence of Mr. Grove, in whose behalf it had fallen to him as a former President, and as one who had filled nearly every office in the Association, to hand over the chair to the President elect.

About a quarter to eight o'clock, considerable excitement was caused by Sir David Brewster having been seen to become suddenly faint. He was conversing with Professor Balfour, who sat behind him, his arm being thrown over the back of the chair, when he ceased speaking, his face became deadly pale, his hand fell from the back of the seat, and he was about to fall, when Professor Balfour sprung forward and caught him. After Sir David Brewster had been extended motionless on the platform, and water brought, in a few minutes he recovered from his swoon, and was carried out of the hall.

After the confusion had subsided, Professor Phillips came forward and said: Our highly honoured member, Sir David Brewster, has been affected by the heat of the hall. He is now decidedly better.

The Duke of Buccleuch, having taken the chair, said—Gentlemen of the British Association for the Advancement of Science, and ladies and gentlemen,—As to what has fallen from Sir Roderick Murchison, I feel that, whatever bold deeds my ancestors may have done, or may have attempted, perhaps in one sense I have attempted the boldest of them all. If it were only a question of physical endurance, or dashing enterprise, I should not have felt abashed, nor shy, nor disinclined for the encounter. I think the old spirit of the Borderer would have carried me through. I have been told, and perhaps with reason, that it is better and more usual upon such a great occasion as this for the President to prepare his speech or address with care beforehand, to commit it to writing, and give an opportunity of having it put in print for the convenience of the members of the Association, and also of those whose particular vocation and duty it is to communicate to the public that which passes at public meetings. Unfortunately, perhaps, for

myself, and still more unfortunately for you, I have not so done. I never in my life attempted to pen an address or to prepare a written speech to be delivered. If I had done so, and had recourse to the productions of the pens and heads of others, I might have read an address to you in flowing language—full of science, full of information; but I could not have pretended that what I read came from myself. I preferred rather to fail by speaking what I had to say direct from myself, as it came from my heart and from my head, than have recourse to the assistance—although most valuable it would have been—of the thoughts and pens of others.

When I consider the nature and intention of this great Association, I cannot but feel that one of the greatest gifts which Providence has bestowed upon man is great intellectual power. It is a talent of the highest price; it is a talent vouchsafed to but few. Happy are those men themselves, and blessed is it for this country and for the world, when they who have the intellectual power have also the will to exercise it, the power to exercise it, and to direct it aright. You will rarely see that any one man possesses the full intellectual power to make himself master of the whole. Ladies and gentlemen, this reminds me that since the last meeting of this Association, and within a very short time, one most distinguished member of it has been gathered to his fathers—I mean Professor Faraday—one of the most distinguished men in his own branch of science, one who having great intellectual power, and having great personal will, was determined to rise above that position in life in which he happened to be born. Happily for him he took a line, and sought a friend in one who was able to forward his views; and I believe that in his own department of science no man was more prominent than Professor Faraday lived to become. In him we have to mourn one that is lost; but when we mourn one that is lost, is it not an incentive to many others who may have been born in the same position as himself, or may, perhaps, have been born in other positions, in a higher and better position than he, with every opportunity of cultivating science, and instructing themselves in every way? Is it not an incentive to every man who may feel himself possessed of that power to push himself forward quietly, unostentatiously, but at the same time, not for the personal pride of position, but for the more generous ambition of being a great benefactor to his country. We heard to-day at the preliminary meeting, a report made upon an important matter—namely, that of having science taught at our public schools—that it should form a portion of the curriculum of study in every school. I quite agree with that, but I think you must not, at all events in the first instance, attempt to push it too far. Give the youth a taste for science, and when they have acquired this taste, those who have an aptitude for the sciences will each be very much inclined to follow a particular science for himself. You can no more drive science down a boy's throat than you can teach mathematics to a horse. (Laughter.) If he has a turn for it, he will take it in; if he has not a turn for it, he will say that it is a greater bore than Latin or Greek; but to teach him the elements of science is of great importance. In every relation of life a knowledge of science is becoming more and more necessary. I need not go further than the town in which we are at present assembled. Where would the prosperity or this town have been had it not been for science. You will say we have manufactures of flax, hemp, jute, and things of that sort; there is not much science in that. Well, go to the cultivation of these plants—go on to the preparation of these plants after they are cultivated, and bring them to this country. Do we not require some amount of science to build those ships, and to navigate them? and when those vessels come to port do we not require some science to produce the docks and harbours in which these vessels lie? Then again, when you come to the manufacture of the raw material, do we not require some science in chemistry and in mechanics; and in mechanics, we require mathematics to begin with? Then, these inevitable faculties are necessary to produce the machinery by which all these raw materials are to be made into useful articles of commerce. Is it not also the case when we come to the cultivation of the soil? What do people do now? It is not the rule of thumb process—the old story, that you must put lime here, and farm manure there. You ask, why? The answer is, it stands to reason—because the soil requires that. Standing to reason is a very good answer; but the man who gives it goes by the rule of thumb. We want a man with science and chemistry to tell us why we do these things—why we apply one description of manure to one soil, and one to another; and why, if we apply this description of manure to one place and to another, we apply it to the wrong place. Again, we have many other branches. Take Geology for instance. I am sure it would be difficult to say how many hundreds of thousands have been sunk and lost in seeking for that wonderful vein of gold in the shape of coal, and other things, which nobody would have dreamt of doing if a question had been asked of any common, ordinary geologist. I was talking a little while ago of scientific education in schools. We want scientific education in our Universities. We want to have natural and physical science taught in our Universities. It is not many months ago since a powerful effort was made to get an endowment for a Geological chair in Edinburgh, which, we may say, is the cradle of geology—where it took its rise, and flourishes particularly. Unfortunately that attempt was simply snuffed out. We met with a cold reception. In vain did we say that endeavours had been made to endow the University of Edinburgh, which happens to be very poorly endowed; but the efforts and contributions of almost all those who responded to the application have been directed to founding scholarships and bursaries to enable poor students who thirst for knowledge to avail themselves of the knowledge which might be afforded there; and we thought the public purse might well afford a professor to teach that which was really of national importance. I cannot pretend to go through all the different points and sections which are taken up by this Association. I will only call your attention to one which I take some interest in—namely, meteorology. There, great efforts have been made, and with signal success, by the British Association for the advancement of science, more particularly at Kew Observatory. What I and others have urged on the Government of the day is the great importance of having renewed and carried on what were called the storm signals at our different ports. This is of immense value and importance; and I believe much valuable property has been saved, and many valuable lives preserved by the timely hoisting of the drum signifying bad weather. At the Firth of Forth I have seen the drum hoisted indicating tremendous storms of wind, and risks that may be run, and yet not a breath of wind blowing in that particular quarter. Some who had not this simple warning might have said, "We might just as well go out to sea, as there is not a breath of wind here." But then, there comes the newspaper, twenty-four or forty-eight hours afterwards, telling of disastrous gales of winds and shipwrecks upon no very far distant portions of the coast. Well, the great thing I may say with regard to this Association is, that it is not exclusive or repulsive. It will neither expel nor repel others, nor will it seek to include within its sphere other societies that ought more properly to be by themselves. I do not know, gentlemen, that I have any right to trespass any more upon your time—I have trespassed already too long, perhaps. I must, in conclusion, be allowed simply to thank the gentlemen of the British Association for the Advancement of Science for the honour they have done me in placing me in this chair. I know it is no slight honour—I feel it is no slight honour—I also feel it is no slight responsibility—but, so far as in me lies, I will endeavour faithfully to perform my duties, and I hope these duties will not be so performed as to show that you

have been entirely deceived in having selected a person for this high position who was totally unfit to be your choice. (Cheers).

Professor Phillips, in an eloquent and interesting speech, passed in review the progress of the British Association and the work it had done towards the advancement of science during the course of 36 years, and concluded by proposing a vote of thanks to the Chairman for the inaugural address he had just delivered.

Section B.—Chemical Science.

President:—Professor Thomas Anderson, M.D., F.R.S.E. *Vice-Presidents*:—Maxwell Simpson, M.D., F.R.S.; Professor Williamson, F.R.S.; J. Lothian Bell, F.C.S.; W. Odling, M.B., F.R.S.; Dr. Gilbert; Professor J. S. Brazier; Dr. Penny. *Secretaries*:—Professor Liveing, M.A., F.C.S.; Dr. Russell, F.C.S.; Dr. Crum Brown, F.R.S. *Committee*:—J. Attfield, Ph.D., F.C.S.; Dr. Barford, F.C.S.; A. R. Catton, F.C.S.; R. Calvert Clapham, F.C.S.; W. Crookes, F.R.S.; John Davy, M.D., F.R.S.; Dr. Heddle; W. E. Heathfield, F.C.S.; P. Spence, F.C.S.; J. Spiller, F.C.S.; E. C. C. Stanford, F.C.S.; Dr. R. Angus Smith, F.R.S.

In the High School.

President's address.

A. R. Catton.—Report on the Synthesis of certain Organic Acid.

A. R. Catton.—On the Synthesis of Formic Acid.

A very animated discussion took place upon these synthetical papers between Professor Wanklyn and Mr. Catton, in which each speaker defended his own views, and attacked those of the other in very energetic language.

J. A. Wanklyn and R. Schenk.—On the Synthesis of Caproic Acid.

J. A. Wanklyn.—Action of Sodium on Valerianic and similar Ethers.

P. T. Main and A. R. Catton.—On a new Synthesis of Ammonia.

J. Spiller.—On the Decay of Stone.

W. Weldon.—On the Regeneration of the Oxide of Manganese.

To-day the sections commenced their regular work. The committee of Section B met at half-past ten a.m., and at eleven the President, Dr. Thomas Anderson, F.R.S.E., opened the proceedings with the following address:—

On many previous occasions the British Association has met in places which have afforded the chemist most valuable opportunities of seeing the principles of his science reduced to practice, and the various papers which have been read at the Section on these subjects, and the discussions which have arisen regarding them, have formed a very interesting department of its proceedings. At the present meeting little of this is likely to engage our attention, for though the manufactures of Dundee have probably increased, during the last ten or fifteen years, in a more rapid ratio than those of any other town in the kingdom, they have taken a direction which gives but little scope for the applications of chemistry, so that with the exception of a few of the simpler operations of the dyer, there is really scarcely anything which need specially attract our attention. Under these circumstances it may be fairly anticipated that the business of the Section will be more particularly occupied with the discussion of the great principles of the science which to the general public are often less interesting, and regarded as the exclusive province of those engaged in scientific study, and not sufficiently recognised as being the only sure foundation on which the superstructure of practical progress can be raised.

The consideration of these general principles is, however, at the present moment a matter of the very highest importance, for the science of chemistry is in a state of transition. The immense accumulation of facts which has been made during the last twenty or thirty years, has not only increased her bounds, but has shown the insufficiency of those principles on which the chemist was formerly ready to rely with almost implicit confidence, and introduced changes amounting to a revolution which have had the effect of unsettling the views formerly entertained by almost all chemists, without as yet introducing anything conclusive in their place. The atomic theory, which at the commencement of the present century explained with clearness and precision all the facts of the science then known, has proved itself (at least in the form in which Dalton left it) no longer sufficient for the purpose. At that time the knowledge of chemists was confined to a comparatively small number of compounds, among which those of oxygen had so preponderating an importance that the science of the time might almost be described as the chemistry of oxygen. At the present moment, if we were to attach to it the name of any individual element we should most unquestionably describe it as the chemistry of carbon, for it is in the study of its compounds that all the difficulties with which the chemist has now to contend have had their origin. At a comparatively early period indeed, doubts were expressed as to the sufficiency of the atomic theory of Dalton, and Ampère especially suggested that the chemical atom might with advantage be considered to be a congeries of smaller particles; but this and other analogous additions to the original conceptions of the chemical atom, having no immediate bearing on the facts then, or even now known, have never been accepted by chemists, or received from them more than a very passing notice, and were not unfairly considered to be unnecessary complications of the theory. It was left for time to accumulate facts, for which Dalton's theory supplied no explanation of any kind, and these were at first neglected, but as their number increased, their explanation was evaded by the invention of names intended to group together facts supposed to be dependent on similar causes. Such names as catalysis, allotropy, and the like really explained nothing, they are little better than scientific lumber-rooms, in which unexplained facts are stowed away until it suits our knowledge or our convenience to classify and explain them. I am far from asserting that this mode of grouping facts supposed to have something in common, has not its advantages, provided only it be distinctly understood that it is the grouping of ignorance. The risk lies in the name being accepted as an explanation, and inquiry being thereby retarded, and something of this sort has indeed occurred, for though these facts were admitted to be beyond the scope of the atomic theory, they were quietly set aside; things went on as they were before, and it was not till the introduction of the theory of atomicity, which shows itself in every chemical fact, that the doubts which had been long gathering in the minds of all thoughtful chemists found distinct expression. I do not on the present occasion propose to discuss in detail the effect which the introduction of this view has had upon chemical theory, further than to remark that it renders it necessary either to abandon altogether the atomic theory of Dalton, or to introduce into it such modifications as fundamentally alter its entire character, and make it substantially a new theory. The former is an alternative which some chemists will be greatly disinclined to adopt. They will not willingly abandon a theory which has admittedly done admirable service, which at its first introduction established order and regularity, where confusion and disorder previously reigned supreme, and under whose influence the science has attained its present goodly proportions. Others again may be of opinion that the atomic theory has done its work and in the future is less likely to act as an assistance than as a hindrance to progress, by forcing us to consider all facts in its particular light, and causing us to overlook relations which might be at once detected by an unbiassed mind.

This latter opinion has been very strongly expressed by Sir Benjamin Brodie, and in the calculus of chemical operations, which he has recently made public, we have the

first systematic attempt which has been made to express the constitution of chemical compounds, by a method in which the idea of an atom has no place. As this is the most important chemical doctrine which has been put forward for many years, and must if accepted materially alter our present views, I shall venture to consider it in some detail, premising, however, that as only the first part of the investigation has yet been made public, any opinion I may now express regarding it, may be liable to modification when the entire investigation is published.

Sir B. Brodie, as has been already observed, discards altogether the idea of an atom, and compares with one another the weights of different substances in the gaseous state which are capable at the standard temperature and pressure of filling a unit of space, which is the bulk of 1,000 cubic centimetres. If we consider this space to be empty, and fill it with hydrogen, a chemical operation is performed which is represented by the symbol α, expressing the fact, that the weight so introduced is chemically indivisible. If now in place of hydrogen, oxygen be introduced, the unit of space is filled by a quantity sixteen times as great, but this weight is not indivisible, as is at once apparent if we notice what happens when oxygen is introduced into the unit of space already filled with hydrogen. In that case a second operation is performed on it, in which a weight eight times as great as that of the hydrogen is introduced, and water is the result. The quantity of oxygen which fills the unit of space, must therefore be regarded as divisible, and this is expressed by assigning to it the symbol $\theta 2$, indicating the fact that two identical operations are required to fill the unit of space with oxygen. By the same line of argument it is concluded that sulphur, selenium, &c., must be similarly constituted, and they are accordingly represented respectvely by $\theta 2\lambda 2$, &c. So far it will be observed that the system is merely a modification of that at present used by chemists for expressing the laws of gaseous combination, excepting that all substances, compounds as well as elements, are referred to the unit of space, while, according to our present plan, the former are referred to two units of space, and the latter to one. But when the compounds of chlorine and the allied elements, with hydrogen, are to be represented according to Sir B. Brodie's system, it at once becomes apparent that some further hypothesis must be introduced if they are to be referred to the same volume. When the quantity of hydrogen represented by the symbol α, unites with chlorine, the product fills two units of space, and as, according to the fundamental hypothesis α, is indivisible, the question is to obtain some means of expressing without fractions the quantity of hydrochloric acid, which fills the unit of space. This end Sir Benjamin attains by assuming that chlorine is itself a compound of hydrogen with an unknown element to which the symbol χ is assigned; chlorine being $\alpha\chi 2$, and formed by these operations, one being hydrogen, and the other two which are identical, result in the introduction into the unit of space of two quantities of a hypothetical substance χ, whose weight is 17·25, and according to this view, when hydrogen and chlorine unite, the action is expressed by the equation :

$$\alpha\chi_2+\alpha=2\alpha\chi$$

On precisely the same principle iodine, bromine, nitrogen, phosphorus, antimony, and bismuth, must also be hydrogen compounds. It is obvious, therefore, that Sir Benjamin's system involves a very large amount of hypothesis, for it assumes that a considerable number of those substances hitherto regarded as elements are really compounds. I do not imagine that much difficulty will be experienced by any one in admitting the possibility of this, for I apprehend there is no chemist who imagines those bodies which we call elements to be the ultimate constituents of matter, or who doubts that the time, though still far distant, will come when they may be resolved into simpler substances. But when we come to reduce these speculations to a definite form, and seek to make them part of the science itself, it becomes essential to subject them to a very close and searching scrutiny.

In order to justify their assumption, it seems to me necessary either that they should be supported by experimental evidence, or that they should afford the means of tracing out unsuspected relations, and thus extending the bounds of the science, or, at all events, that they should involve the minimum amount of hypothesis. Now, as regards the first of these, it is unnecessary to observe that there is not one tittle of evidence to show that chlorine is a compound any more than hydrogen itself. As far as extending the bounds of the science is concerned, we must look for an answer to the future, and it may be expected that in the remaining parts of the investigation, which it is to be hoped will soon be made public, it will be shown how the method may be used for this purpose; but, in the meantime, I confess I am unable to see how it can be used so as to open up new fields of inquiry, and it is certain that it leaves unexplained all those anomalies which are encountered in the existing system. Neither can it be asserted that the system involves the minimum amount of hypothesis, for, in point of fact, the assumption of the compound nature of certain of the elements is rendered necessary by the fundamental hypothesis that α is indivisible. If it be assumed to be divisible, the necessity for holding those elements to be compound at once falls to the ground, and I confess it appears to me that we should require very clear evidence of the advantages it offers before we accept a hypothesis involving so many others. The question must at best be considered as still *sub judice*, and the method is not likely to meet with general acceptance until it is supported by a much larger body of facts than those we at present have.

While Sir B. Brodie's theory is one from which the idea of atoms is excluded, it is important to notice that it is by no means incompatible with them, and it even appears to me that though it may suit our convenience to consider matter in relation to space only, the real subject of inquiry is not the unit of space, but the unit of matter, and to it we must eventually come. If I hold, as I most undoubtedly do, that the atomic theory of Dalton must sooner or later be abandoned, it is not because I do not believe in the existence of a unit of matter. Whether we assume it to be a hard spherical particle, a centre of force, or a vortex produced in a perfect ether, is another question; but it seems evident that some kind of molecular hypothesis is indispensable for the explanation of physical phenomena, and it is scarcely possible to doubt that some connection must exist between the chemical and the physical unit of matter. In the mean time it is only by the most cumbrous and improbable assumptions that the existing atomic theory can be made to fit in with the facts which chemistry has recently discovered, and of these the theory of atomicity is one which can scarcely be connected with it at all. The fact is that theory is a merely temporary hypothesis, constructed to keep before our eyes the tendency which substances have to form compounds of certain definite forms, under special circumstances; and it is scarcely possible to doubt, that in 20 or 30 years it will have passed away and have been replaced by something of a more satisfactory character. Meanwhile its important influence on the recent progress of chemistry is too obvious to be disputed. It is only to be regretted that so many conflicting modes of considering the atomicities of the elements should have been introduced by different writers. Into the consideration of this matter I should have been glad to have entered at some length, but I feel that I have already detained you too long from the actual business of the Section, and no doubt opportunities will arise in the course of the business for individuals expressing their opinions on this and other subjects. Among these the mode of expressing the symbols of chemical compounds, which was objected to long since by Sir John Herschel, and has been again brought into

prominence by the publication of Sir B. Brodie's paper merits attention. The present unsettled state of chemical nomenclature, so inconvenient to the teacher, ought also to be discussed, and it might even be well to consider whether a committee should not be appointed to ascertain how far it might be possible to adopt a uniform system. Nor do I think we ought to separate without recording our opinion on the subject of better and more extended scientific education. The events of the Paris Exhibition have brought our deficiencies in this respect very conspicuously before us, and show us how much we have yet to do. That we have made progress in this respect is not to be doubted. Science is much more cultivated than formerly,—it is becoming more and more a branch of general education. Much, however, still remains to be done in this direction, especially in Scotland, and it will no doubt surprise many of my audience to hear that chemistry and natural history are still excluded from the course of study for degrees in arts in the Scotch universities. Of late years the study of this and other departments of natural science has been introduced to some extent in schools both in England and Scotland; but, I must confess, with but little advantage, so far as my experience goes. The failure, I think, lies in the kind of instruction offered; the usual practice having been to give a course of lectures from which the discussion of principles and of everything which exercises and developes the mind, is eliminated, and only that which it is supposed will entertain or surprise is retained, and boys are thus led to look upon science merely as a pastime. They are shown enough to see the difference between this and the closer and more severe system of study pursued in the other departments of their education, and they are apt either to avoid work altogether, or to acquire their knowledge in a superficial manner. The whole system of teaching science to school-boys is a subject which merits far more attention than it has yet received, and the success of the movement must greatly depend on the method of teaching adopted. All these, however, are subjects the discussion of which would carry me far beyond the limits of those introductory observations with which it has been customary to open the business of the section. It must be left for its members to bring forward their own views on these and kindred questions.

Professor Williamson:—I rise to propose the thanks of this meeting to our worthy President for the address with which he has just favoured us. He has touched on several of the most weighty and important matters which are interesting to us as theoretical chemists, and he has very justly remarked upon the very rapid progress which our science has been undergoing of late years, especially in the way in which existing theories have been made or modified. And it is surely a most encouraging proof of the life which is in our science to see, besides the discovery of facts, these immense evidences which have manifested themselves in all directions. Our distinguished President has also touched on a peculiarly interesting topic to all persons, namely, the introduction into general education of those important results which chemists and others have attained in their special departments. It is certainly to be regretted that these results should remain as yet rather unknown in our schools. It is one illustration of the slowness with which we excuse many results of great benefit to see that these great discoveries are not yet introduced into general education; and certainly we owe our President thanks for the formal way in which he has drawn attention to the importance of introducing scientific education into schools.

The practical subjects which we heard treated of with so much interest in his able address are so fruitful and weighty that I am sure the section will concur with our president in a wish that it may form the subject of one of our meetings, and I would venture to suggest that some early day should be fixed for—I was going to say a field day on the subject of chemical theories.

It seems to me that it is one of our strong characteristics that we are quite as much inclined to the practical as well as to theoretical views, and though we are perhaps to have one field day on theories, I hope there will be many such on the more practical questions.

With regard to the practical introduction of science I ought not to omit to mention that we have present to-day a distinguished member who has collected on the Continent a great amount of facts as to the progress of scientific and technical arts, more especially metallurgy and engineering. I allude to Mr. Lothian Bell, and I hope he will favour us with some of the results of his observations on the subject.

I beg to move a vote of thanks to Professor Anderson, and I am sure the section will be glad to see the printed address of our distinguished President.

The following papers were then read:—

"*On the Decay of Stone; its Cause and Prevention*," by J. Spiller.

For several years past I have been occupied at intervals in studying the causes of the decay of stone, and in experimenting with such chemical reagents as appeared to offer any promise of being usefully applied as means of prevention. At an early state of the investigation I arrived at the conclusion that the corrosive action of sulphurous and sulphuric acids in the atmosphere, resulting from the combustion of coal fuel, operate, in large towns especially, in a very destructive manner upon dolomite and the numerous class of limestones commonly employed in our public buildings. This chemical action, aided no doubt by the simultaneous attack of carbonic acid and moisture, and in the winter season further supplemented by the disintegrating effects of frost, must, I conceive, furnish a sufficient explanation of all the facts observed.

I would here remark that Dr. Angus Smith, Mr. Spence, and others have already directed attention to the immense scale of production of these sulphur acids, and have even quoted statistical data showing the extent or degree of pollution of the air from this cause in the manufacturing districts of Lancashire. When it is known that the *best* class of coal (and coke) contains usually one per cent of sulphur, and that this proportion reaches a treble equivalent when stated in the form of the final oxidised product,—hydrated sulphuric acid,—it follows that a ton of coal of this high quality necessarily evolves during its combustion nearly 70lbs. of oil of vitriol. Here, then, is the origin of the sulphates which we find invariably present in the loosened crust of decayed stones, whether of calcareous or magnesian character. I have tested numerous samples of dolomite, Caen, Bath, and Portland stones fresh from the quarry, and in no instance found more than a trace of ready formed sulphate, whereas scrapings taken from the decayed portions of the stone of the New Palace at Westminster are bitter to the taste in consequence of the comparatively large amount of sulphate of magnesia formed during a few years' exposure to the sulphurous gases occurring in a metropolitan atmosphere. Caen stone from several buildings and localities, Portland stone, and even old faces of chalk cliff in the neighbourhood of Woolwich, were in like manner found to contain appreciable quantities of the sulphate of lime having undoubtedly a similar origin.*

*Caen stone, Northfleet College.

Decayed exterior portion contained of	sulphate of lime	3·4 per cent.
Interior of same stone (sound)	„ „	nil.

Caen stone. St. John's Church, Woolwich.

Scales of decayed stone contained of	sulphate of of lime	4·6 per cent.
Interior portions (sound)	„ „	nil.

A close examination into the circumstances attending the decay of stone at the Houses of Parliament invariably shows an increased liability to corrosion under the projecting eaves and mouldings, and at such sheltered parts of the stone surfaces as are usually covered with soot and dust, and are in a position to retain for the longest period the moisture absorbed during a season of rain. The plain ashlars are throughout very much less affected than the buttresses, gablets, and other elaborately carved and highly ornamental portions of the work, which appear to be more assailable by reason of their relatively greater superficies. In many places the disintegrated stone exhibits white crystals of the sulphate of magnesia, which, alternately dissolving and recrystallising in the pores of the stone, may be conceived to exert a disruptive action sufficient to account for the scaling and fracture of the dolomite which has been so often made the subject of complaint and regret.

With the view of overcoming some of these difficulties I submitted a plan to the Royal Commissioners charged with inquiring into the decay of stone at Westminster, in May, 1861, which consisted in the application to the cleaned surfaces of the stone of an aqueous solution of superphosphate of lime,—a salt remarkable for its action in hardening the surfaces of chalk, Caen stone, or other calcareous building stone to which it may be applied either by brushing or immersion, and which acts upon the carbonate of lime in the stone, giving rise to the formation of Bodeker's salt (crystallized diphosphate of lime $=2CaO,HO,PO_5+4Aq.$). My suggestion received a practical trial in a competition to which other five candidates were admitted by the Right Hon. the First Commissioner of her Majesty's Works, in April, 1864, and in regard to the work executed on that occasion upon three faces of the Westminister Palace I fearlessly await the Government report. In the meanwhile, another promising scheme for the treatment of the decayed stone, especially applicable to dolomite, has been submitted by me to the notice of the First Commissioner, but this new proposal has not yet been selected for trial. It consists in the employment of baryta conjointly with the hardening salt, so that a base may be presented which is endowed with the power of destroying the soluble sulphate of magnesia in the pores of the stone, forming with it the remarkably insoluble sulphate of baryta, and, at the same time, engaging the magnesia in one of its most difficultly soluble combinations. On a recent occasion I have applied this process on a small scale to some Caen stone facings at St. John's Church, Woolwich, which were badly decayed.

With reference to the application of the superphosphate to decayed Caen stone I am able to refer to several successful examples of its use. In the year 1862 I applied the process upon some alms-houses forming part of Northfleet College, where the decay has been completely stopped. In 1864 I operated upon a window and buttress of St. John's Church, Woolwich; and in the following year the façade of the Grand Hotel, Brighton, was treated by my process. With respect to Portland stone, the earliest experiments were made at the Army Clothing Establishment, Woolwich, where in 1861 some decayed window-sills were treated, and with perfect success. I have some interesting results to record in connection with the treatment of Portland stone, which serve to illustrate the increased hardness and strength, and the diminished rate and capacity of water absorption attending the employment of the superphosphate. Small cubes of Portland stone, each of 1·3 inch dimensions, were treated with the phosphate solution and left to dry in the air; these were then subjected to gradually increasing pressure, until crushed, between plates of lead in the American testing machine, at the Royal Gun Factory; and the breaking weights of two precisely similar cubes of the native stone were at the same time carefully determined. The results were as follows:—

		Crushing weight.
I.	Stone in original condition	3,650 lbs.
II.	" " "	3,800 "
	Mean	3,725 "
III.	Stone treated with superphosphate ..	5,375 lbs.
IV.	" " " ..	5,500 "
	Mean	5.437 "

Thus acquiring an increased strength, amounting almost to 50 per cent. The relative hardness of the stone before and after treatment could be readily ascertained by mutual friction of their surfaces, and also by scratching with a pointed instrument of copper, which metal proved to possess a degree of hardness intermediate between the original and treated Portland stones.

The porosity of the stone as indicated by the amount of water absorbed in equal intervals of time proved to be greatly diminished in the case of the treated cubes. On this point several experiments were made, the stone being first weighed in the air-dried condition, and then immersed in distilled water at the temperature of 60° Fahrenheit for the several periods named, and the increase of weight in each case noted.

"Whit Bed" Portland.

	Original stone. Grs.	Treated stone. Grs.
Weight of cube (dry)	1421	1420
Water absorbed in 5 min.	70	7
" " 15 min.	91	8
" " 30 min.	91	12
" 1 hr. 30 min.	92	25

"Base Bed" Portland.

	Grs.	Grs.
Weight of cube (dry)	1291	1335
Water absorbed in 5 min.	120	20
" " 15 min.	122	33
" " 30 min.	124	50
" 1 hr. 30 min.	126	78

These results have been further controlled by other experiments in which the *same block* was used in the original condition, and again after treatment with the superphosphate. It will be noticed that the advantage of the process is most clearly apparent in the case of the denser and more compact variety of Portland known as the "Whit Bed" which alone is employed for external building purposes; the other—the "Base Bed"—is softer and only fit for internal decoration, and its texture is so porous that in becoming saturated it absorbs nearly 10 per cent of water.

Samples of Mansfield dolomite absorbed amounts of water varying in different specimens from 6 to 8 per cent. After treatment by my process the degree of absorption was reduced one-half; and the results were even more favourable in the case of Caen stone.

The cost of materials employed in the treatment of stone according to this plan is very trifling, and bears but a small proportion to the cost of labour necessarily expended upon the cleaning and preliminary preparation of the stone before the solution can be applied. One gallon of solution will cover about 300 feet superficial, when two coatings are applied upon Caen or Portland stone. The superphosphate employed must not contain any appreciable amount of sulphuric acid, and the specific gravity of the solution, when diluted for use, should be about 1,100.

The facts now stated have, it is believed, but a minor interest for the inhabitants of these parts of the United Kingdom; for with Aberdeen granite and Craigleith sandstone at command there will be no need to resort to chemical methods of preservation.

The President said: I am sure the Section will agree in expressing their best thanks to Mr. Spiller for his very interesting communications on a subject of so very great importance, which all of us appreciate, whether we be chemists or not. The destruction of so very magnificent buildings as the Houses of Parliament has been naturally looked upon as a most serious question, and we have looked forward with the greatest possible interest to the result of these experiments, so as to prevent furtber decay. Mr. Spiller's account of the results of his process is, therefore, peculiarly interesting to us, and the observations he made are of peculiar value, inasmuch as they afford us some explanation of the cause of this decay. We can see what is peculiar in the decay, and it shows us how important it is for us to bear this in mind when we are making arrangements such as those in connection with the House of Parliament. At the time when the erection of the building was commenced immense care was bestowed in the selection of stone, and the peculiar magnesian lime-stone was selected because it was found that all the buildings erected with it in the middle ages were in an entire state of preservation. The president concluded by saying that it had now been discovered that the atmosphere and other influences of the city had affected the stone; but Mr. Spiller's communication would be valuable, as his discoveries were of great importance in connection with the processes for the prevention of decay.

After the President's remarks on Mr. Spiller's paper, a very important discussion took place, in which Professor Ansted, Mr. Spence, Mr. Ansell, and others, took part.

The next paper—not in order of reading, but in practical importance,—was

"*On the Regeneration of Oxide of Manganese in Chlorine Stills*," by Walter Weldon.

The author stated that the essential features of the process consisted, firstly, in the use of an *artificial* oxide of manganese, capable of liberating from a given quantity of hydrochloric acid about twice as much chlorine as could practically be obtained therefrom by means of a 70 per cent native oxide; and, secondly, in a simple method of reproducing the artificial oxide from the "still-liquor." This recovery of the artificial oxide might be performed in the stills themselves, so that a charge of manganese, once placed in a still, might always remain therein, continually generating chlorine; and not only never requiring removal, but never undergoing diminution of properties, nor suffering loss by waste.

The "still-liquor" produced in this process contained no free acid, but was a neutral solution of protochloride of manganese, mixed only with a little chloride of calcium. The artificial oxide was recovered from this still-liquor by adding thereto an equivalent of lime, and then injecting atmospheric air. Double decomposition took place between the lime and the chloride of manganese, producing chloride of calcium, which entered into solution, and insoluble protoxide of manganese, which the oxygen of the injected air rapidly peroxidized. When the artificial peroxide thus produced had been allowed to subside, and the greater portion of the solution of chloride of calcium in which it was formed run off from it, it was ready to be treated with hydrochloric acid, from which it then liberated chlorine, with reproduction of exactly such a "still-liquor," as was commenced with. From this point the series of operations described was to be repeated as before,—and so on, continually.

The oxide of manganese so obtained was *hydrated* in an exceedingly fine state of division, and it shared with all such artificial hydrates the property of being far more readily soluble in acids than a hard, compact, anhydrous *native* oxide. In fact, instead of requiring, like the native oxide, long digestion, aided by heat, in a large excess of acid, the artificial oxide dissolved, even in the cold, and with extreme rapidity, in an equivalent of acid, producing a neutral "still-liquor." Hence, the full theoretical yield of chlorine could be practically obtained from simple equivalents of acid and oxide, and this with a considerably less expenditure of time, labour, and fuel than the inferior yield obtained by means of the native oxide required. When using a 70 per cent native oxide it was rarely found possible to obtain in the free state more than *one-sixth* of the chlorine contained in the hydrochloric acid put into the stills; but an artificial oxide of only 55 per cent liberated *one-third* of the chlorine contained in the acid put into the stills, and in less time, and at a less cost for labour and fuel, than the native oxide required for the liberation of half the quantity. A 55 per cent oxide thus enabled a given quantity of hydrochloric acid to yield twice as much bleaching powder as a 70 per cent native oxide did, saving in this item alone from £5 to £7 per ton of bleaching powder.

This evening Professor Tyndall, F.R.S., will deliver an experimental lecture in the Kinnaird Hall, "*On Matter and Force*." This, although addressed to working men, promises to be the most attractive lecture of the meeting. At the same time there will be an artistic and industrial exhibition and soirée in the Volunteer Hall. I have just returned from a private view of this, and consider that it will compare favourably with similar exhibitions at former meetings of the Association. The walls of the large Hall are covered with paintings, ancient and modern, of the most valuable description. Amongst the paintings was an excellent likeness of the late Professor Faraday, but it was perched in such an elevated position that few would notice it. This might surely have taken the place of some of the local worthies on the line.

There are also several excellent photographs exhibited, including specimens of Mr. Woodbury's new micro-photo-sculpture process, or mode of representing in relief microscopic objects; (these will be described in the chemical section); a very fine example of the Woodbury-type, from a negative by W. Bingham. Mr. Spiller exhibitsa selection of military photographs; Mr. H. Butler shows some beautiful photolithographic reductions; and Mr. H. B. Pritchard photographs upon silk, satin, cambric, &c. There are also exhibited a large collection of fossils, shells, fishes and reptiles preserved in spirit, and other objects of interest.

Popular Scientific Information.—Tin Assays.—In the *Mining Journal* of Aug. 17, in a report upon the Missouri tin discoveries, we find the following.—"Professor H. M. Beauregard, a graduate of the Paris School of Mines, writes as follows." "I have three comparative assays with specimens obtained from the surface of the code. First, from a light to a dark green colour, showing in an unmistakable manner the presence of black tin, exhibiting the same characteristics, as specimens from the tin mines of Saxony. Second, from some specimens of yellow and gray yellow streaks, containing a small quantity of tin; and if we take into consideration their position of the surface, they present very good indications. Third, the brown specimens contain no metal; however, the covering of 'putty' which is found very abundant, is of a rich quality, and if we consider that these assays were made in open air, that tin is the most *oxydable* of metals, and that it is necessary to obtain a temperature of heat equal to 442° Farenheit in order to smelt it into ingots, the object in view, to establish the fact of the presence of tin, is reached"!!

ON THE PRACTICAL LOSSES IN THE BLEACHING-POWDER MANUFACTURE.

By C. R. A. WRIGHT, B. Sc., F.C.S.

THE difference between the amounts of bleaching powder of a given strength obtainable theoretically and practically from a given quantity of manganese ore, depend mainly on three circumstances, viz :—

1. Incomplete decomposition of all MnO_2 used.
2. Loss of chlorine by leakage from the generators, conducting pipes, and powder-chambers, and non-absorption by the slacked lime of all the chlorine supplied to it.
3. Deterioration of the powder made, either by loss of hyphochlorous acid from the action of the atmospheric CO_2, or by conversion of hypochlorite into chlorate and chloride, or other compounds deficient in bleaching-powder.

In practical working, it is very difficult to obtain a good estimate of the several amounts of loss experienced from these three causes; the total loss, however, is readily calculable when the weights of manganese ore and bleaching-powder used and made, and the average percentage of MnO_2, and available Cl contained therein, are respectively known. Thus, taking 55 and 35·5 as the respective equivalents of manganese and chlorine, 100 parts of manganese ore containing M per cent of "available binoxide" should yield $\frac{71}{87} \times M$ parts of chlorine, and consequently should theoretically give $81{\cdot}61 \times \frac{m}{n}$ parts of bleaching-powder containing n per cent of "available chlorine."

The following results were obtained as the average losses, in different periods extending over several months each, in a works manufacturing upwards of 70 tons of bleaching-powder weekly.

Average per cent of available chlorine in the powder packed in casks ready for sale.	Average per cent of available MnO_2 in the manganese ore used.	Practical yield: the theoretical being taken as 100.
35·00	64·00	76·8
35·35	66·50	75·7
35·19	66·70	72·8

On the whole, therefore, the total average loss is just 25 per cent of the theoretical yield.

These results were obtained by the "Lancashire" mode of working; *i.e.* where the chlorine generators, or stills, are formed of flags from 4 to 7 inches thick, jointed together and made tight by a composition of fire-clay and tar, known technically as "Barytes." The average amount of powder manufactured per square foot of surface on the floor of the chambers was 13·5 lbs. weekly; while the ratio of the cubic contents of the stills to that of the chambers was about 8·1 to 100. Out of a 100 parts of chlorine contained in the salt decomposed, upwards of 80 were obtained as yellow muriatic acid of 25° Twaddell (25 per cent of HCl), and 15 in the shape of bleaching-powder.

It was found that the average percentage of chlorine found in samples taken from the floor of the chambers immediately they were opened was about 1 per cent more than the average in the same powder when packed in casks ready for sale, and, contrary to expectation, that this difference was almost exactly the same in hot weather as in cold; the numbers obtained being :—

	Summer months.	Winter months.
Average of samples from chambers	35·09	36·71
,, ,, casks	34·98	35·71
Difference ..	1·11	1·00

This difference therefore amounts to $\frac{1{\cdot}05}{36{\cdot}4}$ or three parts in 100 on the average for a whole year, and probably represents the atmospheric action on the powder during the processes of packing in casks, &c. Bleaching-powder manufactured in hot weather was frequently found to contain perceptible quantities of chlorate; samples kept in a warm place in sealed bottles were found at the end of some weeks to contain several per cents of chlorate; it was, however, found impracticable to determine the average amount of chlorate found in the process of manufacture.

The physical character of the sifted and slacked lime employed was found to have a great influence on the rapidity of absorption of the chlorine, and on the quality of the powder produced. It was noticed generally that those quicklimes technically called "Fat," (*i. e.*, which slack, rapidly falling to a fine flowery powder,) gave always the most satisfctaory results; whilst poorer limes which did not slack so quickly, and yielded a gritty powder after slacking, absorbed chlorine much less rapidly, and gave a bleaching powder deteriorating much more rapidly on keeping. Samples of these two kinds of bleachlng powder kept in a warm place under the same conditions acted thus: less chlorate was found in the first kind (Fat lime), and no gas was evolved; more chlorate was found in the second kind, and frequently gases were generated, rupturing the sealed vessel containing the same. On making careful analyses of the limes from which these powders were made, scarcely the slightest chemical difference was detectable, all containing but a few tenths per cent of combined silica, and scarcely any other impurity; physically, however, the former kind attracted moisture from the air very much more rapidly than the other.

By way of comparison with the foregoing numbers, the following calculations are given, based on data given in "Richardson and Watts's Technological Dictionary," vol.i. part iii. p. 379 :—

(1.) 26 cwt of 64 per cent manganese yield 24—26 cwt. of powder of 35—38 per cent of chlorine; averaging, therefore, 25 cwt. at 36·5 per cent. Hence the practical average yield is 61·2 per cent of the theoretical amount.

(2.) 2240 parts of salt give 2753 of acid of 28 per cent HCl, and with 448 parts of manganese ore at 60 per cent, yield 416 of bleaching powder at 39 per cent. Assuming the salt to contain, as is probable, 93 per cent of NaCl, out of 100 parts of chlorine contained in the salt, 59·3 are obtained as strong acid, and 12·8 as bleaching powder; the practical yield of powder from manganese being 74·0 per cent of the theoretical quantity.

Chemical Laboratory, St. Thomas's Hospital.

Silicium-mercaptan.—C. Friedel and A. Ladenburg.—Pierre's silicic chlorosulphide, which is prepared by passing a current of hydric sulphide, charged with the vapour of silicic chloride, through a red-hot porcelain tube, the authors find to be a mixture of silicic chloride, and a body of the composition $SiCl_3SH$. They may be separated from each other by repeated fractional distillations, the new compound distilling between 95° and 97°, silicic chloride at 59°-66°. The reaction by which the silicium-chlorsulphhydrate is formed may be represented by the following equation :

$$SiCl_4 + H_2S = SiCl_3SH + HCl$$

Bromine gives rise to the formation of silicic chlorobromide according to the equation :

$$SiCl_3HS + 3Br = SiCl_3Br + BrS + BrH$$

This bromide resembles silicic chloride closely; it boils at 80°, and gives off fumes when exposed to air. Its density was found 7·25.

NOTICES OF BOOKS.

The Elements of Natural Philosophy; or, an Introduction to the Study of the Physical Sciences. By CHARLES BROOKE, M.A., F.R.S., Pr.M.S., &c. Based on the treatise by the late Golding Bird, M.A., M.D., F.R.S., F.L.S. 6th edition, 3rd by present author, amended and greatly enlarged. London: Churchill and Sons, 1867.

ALTHOUGH entitled a 6th edition this may be considered in all essential respects a new work, as not only the illustrations and facts, but even the theories adopted are those current at the present time. The author, in an introduction entitled, "On the Nature of Energy and the Correlation and Transmutations of its various Physical Forms," explains the views now held by scientific men in place of the old ideas of imponderable fluids, the conversions of energy from form to form, and the probable mode of propagation of the so-called wave motions through material substances. It is rather unfortunate that in an introduction such as this to a purely scientific work, and immediately after endorsing the opinions of our leading scientific men as to the connection and relations of force and matter, the author should expressly condemn those who would advance science a step further, and by hypotheses such as Darwin's, endeavour to connect the varied forms of life existing around us. If this be presumptuous and beyond the domain of science, who shall say which of the questions treated of in this work are not? Those who persecuted Galileo evidently held the same opinions concerning astronomy, yet they were defeated eventually, as all must be who attempt to impose limits to human knowledge, and would say to it, "Thus far shalt thou come and no further."

With the exception of this passage, which should never have been introduced in a scientific work, and might advantageously be left out in the future editions that are sure to be needed, the work appears a most excellent one, well adapted either to be a manual for the student or a work of reference for the scientific inquirer; a copious index at the end of the volume renders it specially suitable for the latter purpose.

A work of this kind, treating of subjects that are altering from day to day, is naturally valuable in proportion as it includes recent inventions and improvements,—with the older parts of the subject, there are already many means of becoming familiar; the author seems to have taken this view, and acted accordingly; indeed it would be hard to say what invention or discovery of any general interest is omitted. An illustration and a full description of Ansell's fire-damp indicator is given as exemplifying the diffusive power of gases, while the chapter on the principles of mechanism is aptly concluded by a full account of Babbage's difference engine, and that on magnetism includes the various methods of correcting the compass errors in iron ships, and the principles upon which they are applied; none of the methods now employed, however, seem to be quite satisfactory,—at all events, for the first year or so after the ship is built, and before the iron has had time to assume its normal condition. In electricity, especially, we find much new and very valuable matter introduced; *ex. gr.*, Sir William Thompson's beautiful electrometers and galvanometers recently employed in the laying and working of the Atlantic cables; Wheatstone's electric balance and ingenious automatic printing telegraph; Siemens's polarised relay, now so generally used in connection with the Morse instrument; Wilde's magneto-electric machine, and Wheatstone's, Siemens's, and Ladd's modifications; the galvanic cautery, &c.; while the theoretical part comprises Ohm's laws, the method used for determining the standard of electrical resistance known as the B A unit, the principles of testing cables, localising faults, &c., and the latest discoveries of Becquerel and Marcus in thermo-electricity.

Where there is so much in the book that is excellent it seems invidious to find fault, but it is difficult to conceive how, whatever mode of classification be adopted, oxygen and hydrogen can be classed together as electro-negative elements, while platinum and potassium both come under the title of electro-positive elements. Whether a body be positive or negative, of course depends upon the substance it is compared with, and the fluid in which it is immersed; but in no fluid ever tried will oxygen and hydrogen, platinum and potassium, appear other than at opposite extremities of the scale. The extent to which a body is positive is usually considered to depend on its affinity for oxygen, water being the exciting fluid; but here the author, if we understand his table rightly, would actually make hydrogen negative to platinum! It is true the author states in explanation that many of the elements are arranged according to their chemical analogies, still the chemical dissimilarity between oxygen and hydrogen is certainly as great as the electrical.

The latter portion of the book is devoted to the consideration of light and heat, both of which forces have lately received much attention from our leading scientific men. Spectrum analysis, and the wonderful discoveries, terrestrial and celestial, effected by its means, forms a very interesting portion of the chapter on light, and is illustrated by diagrams of many of the more curious spectra of substances and celestial bodies; the difficult subject of polarised light is also very fully dwelt upon, and the generally received theories to account for its phenomena are clearly explained.

The chapter on heat contains a great amount of new matter, comprising the recent researches of Professor Tyndall on the powers of absorbing radiant heat possessed by various bodies; in treating of regelation however, the author seems rather to have misunderstood the explanation of the phenomon recently arrived at by the experiments of Professor Tyndall when he speaks of it as a "plastic property of ice," and says, "This action is probably analogous to the welding of two pieces of iron, depending on a plastic or viscous condition of the immediate surface, intermediate between the solid and the fluid states." This explanation is contrary to the meaning of the term "regelation," and, though at one time it was commonly received, later researches have satisfactorily proved it to be erroneous. With the exception of one or two passages, like those we have mentioned, which are not of very great importance, and may readily be corrected in a future edition, the work appears carefully written, and the views enunciated such as are now held by our leading physicists; as a book of reference, therefore, it will be found extremely valuable, and may, we think, be very safely depended upon.

Tables of the Spectra of Metals from the Original Drawings. By C. KIRCHHOFF and R. BUNSEN. London: W. Ladd, Beak Street, W.

We have received Table 2 of this set of spectra diagrams. The characteristics of the various elements are shown very clearly, the field being about two feet in length. The spectra of indium, carbon, boron, manganese, lead, copper, cobalt, nickel, and iron are exhibited in this diagram, as obtained from their chlorides. The colouring is good, and in most cases the bright lines represent the actual spectra better than could be expected by those who have experienced the difficulty of imitating the spectrum by aid of a paint-box.

CORRESPONDENCE.

CO-OPERATIVE CHEMICAL CLUB.

To the Editor of the Chemical News.

Sir,—I was very much pleased with Mr. Durham's letter in your last number, as it embodies an idea that had many times flitted before my mind without taking any tangible form. There are many, no doubt, who would be glad to avail themselves of the privileges of a Chemical club, with a laboratory and library attached, and if such were started in this city by a few influential gentlemen I believe it would be self-supporting and be the means of reviving a taste for scientific pursuits that I fear is now much upon the decline.

In the metropolis no doubt there are some establishments of the kind, but in smaller cities no such advantages are to be obtained, and those who wish to pursue experimental chemistry must fit up a room in their dwelling-houses, which as they are constructed in these modern times, are quite unsuited to the purpose, and a source of inconvenience. I trust, Sir, you will give this question the assistance which your valuable paper affords, and that much good fruit may come of it.—I am, &c.,

Inquirer.

THE PREVENTION OF BRIBERY.

To the Editor of the Chemical News.

Sir,—With your permission I will now endeavour to show how the bribery and corruption described in my former letter on "the tricks of Trade" may be, to a great extent, prevented. Firstly, all travellers who solicit orders should be told—The only condition on which we can do business with you is that you give no gratuities to our men. They have not, in our establishment, the power of selecting wares. A corresponding intimation should be given to every foreman on his engagement. I should even suggest the formation of a protection society among master dyers, printers, etc., in which the names of all detected offenders—whether givers or receivers of bribes—should be confidentially circulated.

Secondly, all mordants, colours, etc., on arrival, should be delivered, not into the dye-house, but into a ware-room, to be issued out to the dyers from day to day, as may be requisite. The books of the establishment will then show, with tolerable accuracy, how much of any particular ware is needed for dyeing such and such goods; and any intentional waste, such as pouring the contents of a bottle down the sink, will be at once detected.

Thirdly, all wares should be carefully weighed upon arrival—a step frequently omitted, lest the warehousemen should be bribed to pass deficient weights; this process should from time to time be watched by the master, manager, or head-clerk. All packages should likewise be tared as soon as empty. Bottles of liquids should be tried with the hydrometer, to see whether they have all the same, or nearly the same specific gravity. Any package or bottle which appears to have a private mark or sign upon the label should be at once impounded for further examination.

Fourthly, the dyer using any lot of ware should be called upon to give his opinion in writing as to its quality. These papers should then be carefully preserved. If the dyers can be kept in the dark as to the precise number of bottles, etc., arriving from any place on a given day, so much the better. But the main method for frustrating bribery is exemplified in the following incident:—A foreman dyer had long been complaining of the extract of quercitran-bark supplied. To put him to the test the maker was requested to obliterate all marks of ownership on a cask, to fill it with the very same extract, and send it by a strange cart. This was done, and the extract was pronounced excellent, and nearly double in strength to the previous lot! If a dyer is suspected of praising a bad article or condemning a good one, out of corrupt motives, ply him with samples merely numbered, or marked in cypher, and require his opinion as to their comparative value. If he has not been acting honestly, he cannot avoid committing himself.

These recommendations will doubtless involve a little trouble at the outset, but if perseveringly acted upon I feel confident that they will abate, if not destroy the evil in question. I know that honest drysalters and manufacturing chemists will be very happy to co-operate in the proposed measures.—I am, Sir, yours, &c., W.

MISCELLANEOUS.

The Atmosphere of the Metropolitan Railway.—An inquest was held on Friday last on the body of Elizabeth Stainsby, who died very suddenly while travelling on the Underground Railway. This is the third sudden death on the line within a few weeks. Previous to entering the Bishop's-road station she complained of a pain in her chest. Upon reaching the platform she remarked, "It is a very nice station, but it feels very hot." As soon as the train started she exclaimed, "Dear me, what a dreadful smell there is," and these were the last words she uttered. When they had proceeded some distance into the tunnel she seemed to suffer great inconvenience, and fell sideways, with her head upon the shoulder of her companion. After leaving Gower-street station she struggled and gasped a great deal, but upon reaching King's-cross she sank apparently fainting. Although Farringdon-street was her destination, she was at once removed to the waiting-room at King's-cross, and a medical man was sent for, but it was found she was quite dead. Dr. Popham, who made a *post-mortem* examination, when pressed to state whether, in his opinion, the atmosphere of the Underground Railway had hastened death, declined to give a decided answer. He had no doubt, however, that air containing a large quantity of sulphurous acid gas and carbonic acid gas would hasten the death of a diseased person. The companion of the deceased stated that the atmosphere of the tunnel between Portland-road and King's-cross was particularly oppressive. In accordance with the strong opinion of the jury, the coroner adjourned the inquiry for the purpose of obtaining the result of a chemical analysis of the atmosphere of the tunnel. We since learn that the directors of the Metropolitan Railway being anxious that the facts should be inquired into by competent and impartial persons, so as at once to remove all possible cause for anxiety, have requested Dr. Letheby, the medical officer of health for the city of London, in conjunction with Dr. Whitmore, the medical officer of health of Marylebone, and Dr. Bachhoffner, to report to them, after a thorough investigation upon this subject, and those gentlemen are now engaged upon the inquiry.

New Mode of Anatomical Research.—Professor Braune, of the University, Leipsic, has just published a method of making accurate drawings of the human system, which is at once novel and startling. He first freezes the subject to a metallic hardness by exposing it to a temperature many degrees below zero for a sufficient period of time, then with a fine saw he severs the frozen body in any direction as may be desired. If proper saws are used, these cuts will be perfectly clean and smooth; over these cuts a stream of water is poured, which instantly freezes, as the whole operation is carried on in a room at a low temperature, and the ice forms a sort of transparent coating to the severed surface, revealing very distinctly every part and outline.

Temperature required for forming Fusible Combinations, and for Melting the same.—C. Schinz. Schinz finds by application of a thermo-electric pyrometer, that silicates are formed and melted at the same temperature, and that the formation of the silicates depends more on time than on temperature, *i.e.*, it depends, in fact, on the conducting power of heat, which the materials composing the silicates possess. He also finds the temperature required for melting metals and metallurgical products to be lower, as formerly has been stated by Plattner. The latter states that a temperature of 1,789°—1,876°C. was required for forming silicates of iron, and of 1,431—1,445° for melting the same. Schinz now finds that a temperature of 1,000—1,156°C. is sufficient for both purposes. He also finds that a temperature of a glass-furnace in operation is only 1,100—1,250°; that crystal glass is worked at 833°, and becomes completely liquid at 929°. A Bohemian green glass tube softens at 769°, and becomes liquid at 1,052°. Pure limestone loses its carbonic acid by heating for several hours at a temperature of 617—675°C. An increase of the temperature will shorten the time.—(*Dingl. J.*, bd. 182, p. 206.)

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Kunst und Gewerbeblatt. May.

"On the Crystallization of Glycerine and on the Action of Impure Glycerine on the Skin." R. WAGNER, "On the Quantitative Estimation of Essence of Mirbane (Nitrobenzol) in Oil of Bitter Almonds."

Journal für Praktische Chemie. April 25, 1867.

H. KOLBE, "Remarks on Heintzel's Memoir on Triamidophenol." BOTTGER, "On the Use of Antimony in Voltaic Batteries." F. HOPPE-SEYLER, "On the Presence of Indium in Wolfram." P. SCHOTTLANDER, "On Hyposulphite of Platinum and Soda." F. BAUMSTARK, "On the Action of Oxychloride of Sulphuric Acid on certain Organic Compounds." A. LIELEGG, "On the Spectrum of the Flame from Bessemer Converters."

May 9.

R. HERMANN, "On the Atomic Weight of Tantalum, and on the Composition of the Compounds of that Metal." "On a Double Fluoride of Antimony and Arsenic." T. PETERSEN, "Contributions to the Theory of Leblanc's Process." "A. C. OUDEMANS, "Experiments on some East Indian Fats and Oils."—"Experiments on Palm Oil from Surinam." W. F. GINTL, "A new Pinch-cock for Stopping India Rubber Tubes." H. HLASIWETZ, "On Hydrocaffeic Acid," G. TSCHERMAK, "On Glaudocote, Danaite, and Arsenical Pyrites."

May 24.

J. G. GENTELE, "On C. Friedel and J. Crafts' Paper, or a new Alcohol in which Carbon is partly replaced by Silicium, published in the *Comptes Rendus*, vol. 61, p. 792."—"On the Boiling Points of Ethers and Alcohols, and of the corresponding Sulphides and Sulphydrates."—"On the supposed Identity of Benzylamine and Toludine."—"On the Similarity of the Behaviour of Carbonic Oxide and Nitrous Oxide in Chemical Compounds, where they replace a Base or an Acid." C. F. SCHONBEIN, "On the Accelerative Action of Liquid Hydrocarbons and other Bodies rich in Carburetted Hydrogen on the Oxidation of Absolute Alcohol, and on the Formation of Peroxide of Hydrogen which accompanies such Oxidation."

Monatsbericht der königlich-Preussischen Akademie. Feb., 1867.

J. BERNSTEIN, "On the Duration of the Negative Variation of Nervous Currents." R. WEBER, "On some Compounds of the Chlorides of Platinum and Gold." DOVE, "On the Combination of Prismatic Colours to White."—"On the Production of Accidental Colours by the Electric Light."—"On the Inversions which occur on looking at Drawings in Perspective and Transparent Objects with one or both Eyes."—"On the Polarisation of Light by Repeated Reflection." POGGENDORFF, "Observations on Holtz's Electrical Machine." "On a new Electrical Machine invented by Holtz."

Journal des Fabracants de Papier. May 15, 1867.

E. BOURDILLIAT, "On Testing the Chemical Products used in Paper Making." J. NICKLES, "On E. Porion's Method of Utilizing Spent Lyes and other Waste Products of Paper Mills."

Archives des Sciences. May 25, 1867.

M. MICHELI, "On the Colouring Matter of Chlorophyll." L. DUFOUR, "On A. Fick and J. Wislicenus' Paper on the Production of Muscular Force."—"On Franklin's Paper on the same Subject."

NOTES AND QUERIES.

Manufacture of Sulphurous Acid.—Sir,—Any readers of the CHEMICAL NEWS will greatly oblige the writer if he or they could inform him when using the coke tower, or condenser at the end of sulphuric acid chambers if—1st. The gas that is passing out of last chamber should be dark. 2nd. The acidulated water can be used in chambers. 3rd. (If possible) the quantity of water required to condense the residual gases. An early answer will greatly oblige—"A SUPERVISOR] OF CHAMBERS."

Plumbic Chloride.—Sir,—In my paper on the "Solubility of Plumbic Chloride" I find I have made a slight mistake in the specific gravity of HCl, it ought to be 1·16 not 1·116. I should have noticed it before, only I was away from home at the time it appeared.—J. CARTER BELL.

Prevention of Dry Rot.—Sir,—The enquiry of "Mr. T. H. L." in No. 403, has not reached me until now, owing to my absence from home. The timber should be in *contact* with the waste. The latter may not be very easily obtainable in London; at least I am not aware of the existence of any alkali works there. If required in large quantities, the waste might be shipped from Newcastle or Liverpool.—G. LUNGE.

Platinizing Metals.—Sir,—I find great inconvenience from the brass-work of my balance and other instruments being attacked by acid vapours in the laboratory. Some years ago I remember seeing beams and pans of balances which had been coated with a brilliant and coherent layer of platinum, I believe by electro-deposition. Can any of your courteous readers kindly give me directions to prepare a platinizing solution, and tell me what strength of battery is required?—OLINTHUS.

The Word Aneroid.—Sir,—Can any of your correspondents tell me the origin of the word *aneroid* as applied to a barometer? What I want is not a conjectural derivation, or an "I have always taken it to mean," or "to come from," but who was the originator of the name, and what was the sense that he put upon the word? The history of the invention might, perhaps, supply some portion of an answer. A Frenchman, somewhere about 30 years ago, is said to have been the inventor.—K.

TO CORRESPONDENTS.

A. B.—Apply to Mr. Griffin, Garrick Street.

A. Dyer.—Use peach or Brazil wood for the colouring agent.

C. R.—You can so easily obtain the information by consulting any elementary work on chemistry, that we really must decline to occupy so much of our space as answers to your seventeen queries would require.

F. H.—Böttger's method of preparing chloride of platinum will be found in our 11th volume, p. 168.

J. Mandella.—Mix white of egg with the solution; boil and strain; the precipitate will contain what you want.

G. M. A.—Not an article of commerce yet.

N. A.—Picric acid frequently contains a little nitric acid as an impurity. This has attacked the paper. Pure picric acid will not affect paper.

Pharm.—Balm of Gilead is the produce of the *Balsamodendron Gileadense*. The genuine balm is very scarce.

Edward D.—You will find a muffle very convenient for incinerating animal matters. Put the body whose ash you wish to obtain in a platinum dish, and this in a muffle heated to bright redness.

An Old Reader.—By this time you will have received an answer by post.

M. Fleming.—Soak the agate in warm oil of vitriol for some days. This will frequently bring out the bands and markings with great distinctness.

O. Dragon.—If you send the price in stamps to our publisher the book will be forwarded by post.

Inquirer,—The colouring matter is peroxide of iron. Our correspondent will perceive that it is unreasonable to expect us to perform a quantitative analysis simply to oblige an anonymous writer. The Editor is always willing to assist correspondents in difficulties, and never objects to try laboratory experiments, or even perform simple analyses in cases where it would appear that the information so obtained would be of real value; but the carrying out of a research which would occupy several days is more than a correspondent should fairly ask. By referring to our advertising columns the names of several gentlemen may be seen who will be willing to undertake the analysis professionally.

Communications have been received from Victor Cruse; Dr. Phipson; Rev. R. C. Douglas; Charles Tomlinson (with enclosure); M. A. Baines; George Hopwood; John Heywood (with enclosure); J. C. Wilson (with enclosure); Edwin Smith (with enclosure); G. A. Keyworth; J. C. Wilson; John Bray, F.C.S.; E. Ellis; W. Simmons; P. J. Worsley (with enclosure); W. Ladd; F. C. Calvert and Co.; J. Horsley (with enclosure); J. Harry Taylor; A. Scott; Watson Smith; D. J. O.

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SUPPLEMENT
TO THE
CHEMICAL NEWS.
Vol. XVI., No. 405.

ON SOME USEFUL APPLICATIONS OF CHLORIDE OF CALCIUM.

By J. HARGREAVES.

The utilisation of waste products has within the present century become an object of great importance, and the results such, for instance, as obtaining ammonia, benzol, aniline and its derivatives, &c., from coal-tar; garancin from madder waste, acetic and oxalic acids from sawdust and other ligneous materials, ammonia, animal charcoal, and manure from bones, have been sufficiently profitable to encourage further attempts in the same direction. The writer hopes that the following may result in directing attention to some of the means of utilising another waste product.

There is produced in the manufacture of soda by Leblanc's process a larger quantity of hydrochloric acid than can be utilised. The principal use to which it is applied is for the production of chlorine in the manufacture of bleaching powder, but this uses up only a comparatively small proportion of the total production; and many alkali manufacturers throw away nearly all the hydrochloric acid made by them, causing a great amont of mischief in the streams into which the acid is run, in many instances completely ruining them as fishing streams, while the conduct of the luckless manufacturer who can find no better use for his acid, is commented upon by anglers and the lovers of fish diet, in language more remarkable for force than refinement: the former find their sport ruined, and the latter their favourite article of food destroyed.

This acid instead of being thrown to waste can be used to produce chloride of calcium by filling the condensing towers with limestone instead of coke, adding more stone as it is dissolved away by the acid, thus supplying a quantity of chloride of calcium almost unlimited. Or the chloride of calcium may be produced by the reaction of hydrochloric acid on alkali waste in suitable apparatus, and using the sulphuretted hydrogen given off, in the manufacture of sulphuric acid. There are practical difficulties in the way of adopting this mode of making chloride of calcium, but are they impossibilities? The chief difficulties are that unless great care is taken there is an escape of sulphuretted hydrogen which is not only very disagreeable but is liable to explode when mixed with the atmosphere. Great care is also required when burning sulphuretted hydrogen, for if the supply of air is deficient, sulphur is sublimed and passed into the vitriol chambers unburnt and if the supply of air is for a short time cut off, sulphuretted hydrogen is liable to get into the chamber and cause an explosion on the admission of an excess of air afterwards. In fact, making sulphuric acid by the use of sulphuretted hydrogen has after many trials by various inventors been found to be one of those matters which become dangerous and impracticable in the hands of ignorant workmen (another illustration of how the ignorance of a population restricts the sources of wealth in a nation).

Another cheap source of chloride of calcium is to be looked for in the bye products from several other processes for the recovery of sulphur from alkali waste, such, for instance, as that of M. Mond, a description of which lately appeared in the Chemical News. The chloride of calcium has in this case the advantage of being free from arsenic, the arsenic being precipitated along with the sulphur as tersulphide. Another ready source of chloride of calcium exists in the bicarbonate of soda manufacture; the chloride is obtained when limestone is acted upon by hydrochloric acid for the production of carbonic acid.

The chloride of calcium by whatever means obtained, should, if it has to be carried to a distance, be boiled to dryness in a reverberatory furnace, and the heat urged till the chloride is in a state of igneous fusion, then drawn into suitable moulds, and when cold it is in a fit condition for packing and transport. It should be packed so as to be protected from the air, on account of its deliquescence.

One of the most prominent reasons why the collection of manure by sedimentary deposition from sewage is not practised, is, that the greater portion of the manurial ingredients, and among them a great proportion of that most important one, phosphoric acid, are held in solution, while the least valuable are contained in the sediment. Chloride of calcium added to town sewage causes the precipitation of phosphoric acid from the soluble phosphates. The compounds of nitrogen are not, however, precipitated except in a very small proportion, and are therefore lost, when only the sedimentary portion of the sewage is used, but this is of little importance compared with that of the loss of the phosphates, as the atmosphere will in time supply to plants sufficient hydrogen, carbon, oxygen, and nitrogen, though of course the latter elements will not be so rapidly assimilated by the plants, as would be the case were they supplied with the manure; but the mineral elements if once exhausted can only be re-supplied by artificial means. Chloride of calcium added in excess to sewage also exerts antifermentative and antiseptic properties, retarding the decomposition of the organic portion; and when fermentation does occur, the evolution of the nauseous and poisonous sulphide of ammonium produced by the decomposition of organic compounds of sulphur and nitrogen, is prevented, by production of chloride of ammonium and sulphide of calcium,* $NH_4S + CaCl = NH_4Cl + CaS$. And when carbonate of ammonia is produced by the decomposition of compounds of nitrogen, from which sulphur is absent, or fixed by other combinations, the evolution of ammonia is prevented by the formation of the less volatile chloride of ammonium $NH_4OCO_2 + CaCl = NH_4Cl + CaOCO_2$. The addition of the chloride is an effectual preventive of the evolution of compounds of ammonia from stable manure and from cesspools. These properties make chloride of calcium an effective agent in preventing the waste of phosphoric, and, in some cases, ammoniacal compounds, and are well worthy the attention of agricultural and sanitary reformers.

When esparto or other vegetable fibres are used in the manufacture of paper, a solution of caustic soda is employed for dissolving out the resinous and gummy portion of the vegetable from the fibre. The waste lye produced by the operation is allowed to run off in the form of a deep brown-coloured liquid, and consists of extractive matter, and resinous and fatty substances, combined with soda in the form of soap, together with carbonate of soda, caustic soda, and notable quantities of phosphate of soda. All these soda compounds are decomposed by chloride of calcium, causing the formation of corresponding lime compounds and chloride of sodium. The lime compounds being insoluble, are precipitated, carrying with them a large proportion of organic extractive matter, leaving the water with comparatively little colour, and by converting the soda present into common salt, depriving it of many of those noxious qualities which cause paper works to be regarded with such disapprobation when situated on the banks of fishing streams. The precipitate contains all the elements of an excellent manure; its principal disadvantage is owing to the great quantity of water adhering to

* This and the succeeding reactions are inverted when the materials are heated.

it, which renders it difficult to remove, and dilutes the manure; but a little practical experience will remove this objection—perhaps spreading it in shallow layers to dry and drain might make it sufficiently concentrated. The chloride of calcium has, in practice, to be used in excess of the quantity theoretically necessary; that excess, however, does not perceptibly injure the water for supporting life in aquatic plants and animals.

On the one hand, the streams of one part of the country are polluted with a powerful alkali, and in another with a corrosive acid; in both instances the streams are unfitted for supporting animal life. In many cases rivers once abounding in salmon, trout, and other valuable edible fish, are now deserted in consequence of these pollutions. All that is required to put an end to this state of things is to use the one to neutralise the other, and produce a harmless neutral salt, and, at the same time, prevent our manurial wealth leaving us by being carried to the sea.

The writer has not at hand the means for forming a correct estimate of the quantity of chloride of calcium that might practically be obtained; but it is evident to any one having any acquaintance with the immense manufactories of soda on the Tyne, the Clyde, and the Mersey, that many thousands of tons of chloride of calcium per annum may be obtained, and the precipitation that of phosphate of lime from sewage, and the use of that precipitate as manure, would go far to supplement or supersede the phosphates imported in the form of guano and bones. All the materials used in its manufacture are cheap and abundant, in some instances costing less than nothing, inasmuch as some of them have at present to be removed out of the way at great expense of carriage and space in which to deposit them.

Appleton-Widnes, Aug. 19, 1867.

NOTES ON CRYSTALS DEPOSITED FROM THE BRAIN.

By S. W. MOORE.

In the month of June this year (1867), Mr. Stuart, curator of the Museum, St. Thomas's Hospital, called my attention to the fact that he had noticed in some of the brain preparations a deposit of crystals which appeared to him to present a very beautiful and unusual appearance; he thought, perhaps, that I might like to examine them chemically, which I have done, thinking the results may lead to facts which will ultimately throw some light on the now very imperfectly understood compounds of the brain.

On inspecting a jar containing the deposit, there was found a very thick layer of crystals at the bottom, which upon further inspection were seen to have the form of rhombic plates; over these, however, there was a layer of what might have been mistaken for mucous or brain matter, but on examination with the microscope they presented a very beautiful appearance, two or three

distinct forms being apparent, viz.—*a*, small stars, formed of globular bodies (of which there were seven, six aggregated round one), a little smaller than the male human blood corpuscle. *β*, resembling two pieces of tape, one in a semicircle, the other stretched across its diameter, the ends on both sides being twisted. *γ*. This form was one piece only, its ends being brought round upon one another and twisted.

These strange forms suggested the idea that some albuminous principle might probably have united itself with a crystalline substance, and have caused these structures to become manifest in the attempt to crystallise; they gave under the influence of polarized light a distinct cross, and what seems to confirm the supposition of their being a colloid is that upon testing nitrogen was developed. They are saponified by KHO, and dissolved by hot absolute alcohol, and separate out on cooling in a granular form, and are of course insoluble in water.

On presenting the various tests to the crystals which were so densely crowded at the bottom of the vessel, some very interesting data were collected, agreeing with the tests for no other hitherto mentioned brain compound.

In appearance the crystals were waxy, they were tasteless and insoluble in water; on ignition they burned away with a bright smoky flame, leaving no residue whatever. The tests for N, P, and S, were carefully applied, but with no result; the substance was precipitable from its ethereal solution by alcohol; its melting-point was 103° C., and on combustion it gave the following percentage:—

Carbon	43·79
Hydrogen	8·09
Oxygen	48·12 by difference.
	100·00

From this an empirical formula may be calculated, having the following constitution, $C_7H_{16}O_6$, or $C_{12}H_{26}O_{10}$, the latter perhaps giving a calculated result nearer the found one, viz.,—

Carbon	43·64
Hydrogen	7·88
Oxygen	48·48
	100·00

From the results obtained above we may safely conclude that the substance is not cholesterine, its high percentage of oxygen, and its low melting-point, excluding it from that supposition. It is equally impossible that it should be cerebric acid, because it is perfectly neutral and contains no nitrogen, the absence of phosphorus proves it cannot be oleophosphoric acid.

I hope to obtain some more of the substance, when further experiments will be made, from which I shall doubtless obtain something of a more definite nature, and be enabled to give it a rational formula, it appearing to have been up to the present time unnoticed.

On exposing to the air the spirits from which the crystals had been taken, a fresh crop formed; these, however, were only crystalline plates of cholesterine.

REPORTS OF SOCIETIES.

ACADEMY OF SCIENCES.

Aug. 26, 1867.

(From our own Correspondent.)

Death of Dr. Velpeau.—Fleuorine.—M. Chasles' Manuscripts.

A gloom was cast over the assembly by the death of the celebrated Doctor Velpeau, born on 18th May, 1785, at the village of La Briche, in Touraine. The son of a blacksmith and farrier, whom he aided in his trade, he became acquainted with the first notions of veterinary surgery. In 1816 we find him at Tours, a medical student; and in 1820 at Paris, where he was made doctor three years later. Laborious and tenacious, he rapidly amassed money, especially as his private practice was confined to the higher aristocracy. As hospital surgeon of the Pitié, as professor, as academician, he led the example of punctuality,

assiduity, and practical skill in conducting operations, so that he became at once one of the best surgeons of France. In 1842 he was elected to the vacant chair at the Institute, having been previously, in 1835, nominated, though he had for a fellow competitor the celebrated Lisfranc. His titles were: Surgeon to the Charité, Member of the Institute, and of the Academy of Medicine, Commander of the Legion of Honour, Professor of Medicine, and Consulting Surgeon to the Emperor. The numerous works written by him are not so easily enumerated; we have before us the list of 18, most of which are in several volumes and accompanied with atlases and magnificent engravings; without counting all the valuable papers read at various Societies, they prove that he wielded the pen as steadily as the bistuory, or the hammer on the anvil, in his early days.

Surgical and medical science have lost latterly many in their front ranks; Malgaigne, Jobert, Cirale, Trousseau, Charrière, and last, Velpeau. Funeral discourses were pronounced by Nelaton, Riche, Gosselin, Husson, Guyon, and Longett; the latter was pupil and friend of the deceased.

Among the correspondence, which was opened by M. Chevreul, was an important one on fluorine, by M. Pratt. According to this chemist we have been hitherto mistaken upon the composition of fluorides, and on the theory of fluorine. M. Pratt proposes new formulæ, which harmonise better with known analyses. These will be examined in detail when the *Comptes Rendus* appear.

M. Balard presented a note on chloride of ethylene.

M. Blanchard reminded the assembly that at the last meetings of the Academy doubts were expressed upon the existence of unpublished manuscripts of Pascal, which would contain important discoveries. He thinks that these doubts ought to be satisfied by a declaration contained in a passage of the preface of the "Treatise on the Equilibrium of Heavy Liquids," published in French. M. Blanchard states that this preface was probably written by Madame Perier. The edition in the hands of M. Blanchard is dated 1698, and is conformable to those of 1663 and 1664.

M. Faugère having been invited by the president to state his objections against the authenticity of the documents published by M. Chasles, stated that the falsificator had not even well *imitated* the handwriting of Pascal. He said that the forger was merely satisfied in adopting the writing and style of language of the 17th century.

M. Faugère confined his observations to mentioning an anachronism, according to him, most evident. There is a question, in one of the letters, on the froth of coffee; now, the use of coffee was not introduced into France before the end of the year 1669. He contested that Newton never wrote in French, also he remarked upon the common-place style of the letters attributed to Pascal, whose diction was far different, and added that the forger was caught in his own net. He hoped that the imposition upon M. Chasles would be shortly cleared up.

M. Chasles replied that all these doubts have not shaken his confidence in the authenticity of his documents, so numerous and varied.

M. Regnault observed that photography would furnish the means of recognising whether the old papers contained anterior writing that may have been made to disappear. Also there are chemical reagents calculated to revive effaced writing.

M. Chasles declared that he would place at the disposition of the Academy all the letters and documents to be submitted to all manner of tests.

M. d'Abbadic presented on the part of M. Radau a note on the ancient meteorograph and on the theory of the barometer of M. Moreland. We find in the *Journal de Physique* of the Abbè Rozier (1782), a memoir of Magellan, giving a description, accompanied with plates, of a "Perpetual Meteorograph." Seven instruments trace parallel curves on the same diagram, moved by clockwork. The pressure is registered by a wheel barometer, the temperature by a metallic thermometer, and the humidity by a hygroscope constructed of wood; the force and direction of the winds are obtained by a very ingenious anemograph; rain, evaporation and the height of the tides are indicated by apparatus furnished with floats. Nothing is wanting, and in several respects this meteorograph is superior to those recently constructed. The steel yard barometer was invented by Sir Samuel Morland, who presented it towards 1670 to Charles II. Magellan possessed a barometer on this principle, constructed by Jonathan Sisson; he improved the mode of suspension. Later, in 1791, the Rev. Arthur M'Quire le transforma en barographe en attachant un crayon au sourmet du tube (*Transactions* of the Royal Irish Academy, vol. IV.) The theory of the barometer, complicated enough, was not as yet given exactly.

SEPT. 2, 1867.

Death of Faraday.—Godard and Savigny Prizes; Father Secchi on Shooting Stars.—Stellar Spectroscope.

A letter from Mr. Dumas informed the Academy of the loss it has just sustained by the death of Mr. Faraday, one of its foreign associates. M. Dumas made this mournful communication at the request of M. Tyndall, who thought that M. Dumas could, as one of the friends of the illustrious deceased, replace, in the performance of this duty, his family.

M. Chevreul, after having read this letter, added that all the members of the Academy would certainly participate in the sentiments it expressed; he paid a solemn homage to the memory of the great English physicist, and related several facts which manifested his modesty, and the nobleness of his character.

The correspondence included some documents on the definitive disappearance of the great birds of Madagascar (Epiornis Maximus), and on the work of MM. Burden and Bourget, on heat, &c.

M. Chasles replied to the criticisms of M. Faugère. He commenced by enumerating again the very important and varied documents in his possession, among which are about 1,000 documents of La Bruyère (nearly 300 letters, a key of characters, the same which circulated at that time among the intimate friends of La Bruyère, and many other isolated pieces). M. Chasles combatted, one by one, the objections raised by M. Faugère, apparently successfully. He remarked how very improbable it was that a falsificator could fabricate such an immense number of documents of a nature so different. He must have had a great imagination!

M. Chasles cited letters from Desmaizeaux to Fontenelle, in which there is doubt of the relations between Newton and Pascal; they say it was the professor of young Newton who wrote his letters. M. Bertrand remarked how singular it was that no allusion is made to this in Fontenelle's *eloge* of Newton. M. Chasles replied that Fontenelle had requested of Desmaizeaux information as to the youth of Newton before he wrote his discourse. Desmaizeaux, in his reply, said that he possessed Newton's papers, but that his family had confided them to him on the condition of not making use of them. "I will give you," he said, "notes, but which will not injure the reputation of M. Newton, so well re-established." Fontenelle submitted to Desmaizeaux his project of *eloge*, and the latter prayed him not to revive old souvenirs nearly forgotten. Leibnitz knew all these things; he avowed that he had papers of Pascal, *but that he makes no mystery of them, like M. Newton.*

A commission was appointed for the Godard prize, and another for the Savigny prize, founded by Madamoiselle Lettellier, in favour of young travelling zoologists.

Father Secchi made several interesting communications. The first was on shooting stars. The cholera had dispersed the small staff of assistants at his disposal at Rome; nevertheless, he had two observers who determined that on the 10th of November the hourly number was thirty-five between two and three in the morning. Comparing this number with that observed in the previous

year, it appears that at Rome the diminution was not so sensible as at other places. He then presented a stellar spectroscope, of very moderate demensions, made by Secretan; also a memoir on the actual state of the science of meteorology as regards metorographic instruments, and laid upon the table sheets on which the meteorograph of the Exhibition had traced curves.

M. Archiac presented several memoirs relative to geology.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, Sept. 3, 1867.

Scientific Association at Cherbourg.—Electricity of Connecting Straps in Machinery.—The Triangulation of Prussia.

The meetings of the Scientific Association at Cherbourg were terminated on the 24th of August. Nothing was neglected to increase the interest of this re-union of savants and amateurs. Visits were made to the soda and iodine works of M. Cournerie, to the military port, where the *Dunderberg*, now christened the *Rochambeau*, and where the spur of the *Atalante* is being cast; lectures were delivered on astronomy and meteorology, at which the professors attended, furnished with instruments, due to the munificence of the government; and there were also reports, memoirs, notices, and discussions on different points of the natural, physical, and moral sciences.

M. Quesnault, sub-prefect of Valognes, presented a memoir in which he demonstrated that the British Isles and the small archipelago existing on the north-west coasts of France, from the Cape la Hague to Cancale point, or rather, as far as St. Malo, formed part of the Continent, and laid down a map on which all the vestiges of terrestrial vegetation existing, or supposed to exist, under the sea were shown.

M. Lenoir, director of the telegraph at Saint-Lo, called the attention of the assembly to the electricity of connecting-straps in machinery, and the dangers which might result from it in powder works.

A fortuitous circumstance added considerably to the interest attached to this meeting. Lady Franklin, widow of the celebrated explorer of the northern regions, assisted at the meetings of the 23rd and 24th ult. The noble lady had arrived on the 22nd by the American frigate the *Minesota*, accompanied by Miss Grennell, a young lady, the daughter of a shipowner of New York, who had fitted out at his expense two ships for the research of Sir John Franklin. At the last meeting it so happened that M. Lambert gave a description of his project of a voyage to the North Pole. This *rencontre* of Lady Franklin and M. Lambert is described as presenting a most impressive scene to the audience. Lady Franklin was to leave on the 27th on board the pleasure yacht *Leda*.

The first volume of the report on the triangulation of Prussia had scarcely been published when it was attacked on all sides. It comprised the triangles measured in the eastern portion of the kingdom. The first attack was made by Lieut.-General de Baeyer, the former collaborator of de Bessel, who repulsed with much vivacity a criticism made upon certain triangles of de Bessel, contained in the preface of the work in question; he showed, on the same occasion, that the results obtained were in all respects inferior to those of the ancient triangulation of de Bessel, and those of the triangulation of the coasts of Prussia. He stated that, in 1863, the Prussian Government had confided to M. de Baeyer the direction of the survey, and that at that period he had already disapproved of many things in the work which had been submitted to him. The Ordnance department took no notice of his protestations, and published the work in question without even informing M. de Baeyer, who was much surprised to find all the faults pointed out by him, and as many others as they had time to add. He has hastened to disavow this publication in a letter addressed to the *Astronomische Nachrichten*. Lieutenant-Colonel de Hesse, Chief of the Ordnance Department, replied, and undertakes to justify himself, but M. Peters has taken part himself against the department. Moreover, M, Wittstein, Professor of Mathematics at Hanover, has published two articles successively in the same journal, in which he endeavours to prove that the Department of Triangulation does not know what a personal error is, and that it does not know how to *compose* the bearings observed at the same station. M. Wittstein concludes that all the calculations of the triangulation must be made over again.

M. Pisko, professor of physics at the Lyceum of Wieden, at Vienna, has related to us a curious accident which he witnessed, and which is highly interesting to physiologists. The servant of the laboratory of the Lyceum is an old corporal of the *gendarmes*, of a strong constitution and always in excellent health. In the month of February last year he was occupied in cleaning an induction apparatus, and he conceived the idea of trying it with several elements. When he had laid hold of the two handles he could not let them go. Fearing that his imprudence should be discovered he would not cry out for help though he was groaning with pain. He remained in this situation for more than ten minutes, and we cannot tell what would have happened if he had not fallen to the ground and in his fall broken the conducting wire. After some time he recovered the the use of his limbs and continued his usual occupation. The following day he felt some uncomfortable and strange symptoms; when walking he fancied that everything he walked upon was spherical. The next day, about 11 o'clock, these sensations became stronger, both his arms were swelled from the elbow to the fingers, and the legs from the knee to the extremity of the toes; the patient had to keep his bed. When he tried to get up it seemed as if he could not touch the ground, the swelling and the pain attaining its maximum about 2 o'clock and disappearing about 4 o'clock. A doctor was called, in but the man at first concealed the nature of his malady; he said he had stirred the acid of the battery with his hand. Warm baths ordered by the doctor produced no effect. It was only on the fifth day that M. Pisko, absent till then, was informed of the state of his assistant. M. Pisko went to see him, and on his saying that he did not believe the story of the acid, the man confessed what had happened. The Professor then proposed to the doctor who attended the patient to use the same remedy as that applied in cases of lightning stroke, viz., quinine and old wine. This treatment turned out to be efficacious, and by the end of fifteen days the periodical symptoms had gradually disappeared, without leaving a trace. Nevertheless, in the month of February last, just a year after the accident, the same symptoms were renewed, though with less intensity. Treated with the same remedy as before they yielded at the end of eight days. It will be curious to see if the symptoms return in February, 1868.

The Imperial School of Pharmacie has just lost one of its most experienced savants, in the person of M. Guibourt, honorary professor. He was born in Paris, in 1790, and was, at sixteen years old, on the termination of his classical studies, apprenticed to the Boûdet pharmacy. He was author of several pharmaceutical works of the highest merit. By these and his constant studies he acquired, justly, the name of being the most distinguished savant in medical and pharmaceutical materia. Named Member of the Academy of Medicine in 1824, and Professor of the School of Pharmacy in 1832, he was also received into many national and foreign learned societies.

F. Moigno.

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BRITISH ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE.

DUNDEE MEETING, 1867.

(From our Special Correspondent.)

Dundee, Sept. 12, 1867.

The meeting of the British Association, which has just terminated, must be regarded as most successful either from a scientific, financial, or social point of view. The actual number of members and associates at this meeting is 2,444 (this nearly equals the Aberdeen meeting (2,580) in the year 1859, when the Prince Consort was President); and the happy combination of science and relaxation which each day's programme has provided will cause the past week to be remembered with pleasure.

The attendance in the Sections was better than could have been anticipated, and the earnestness of the frequenters of Section B was shown, if not by the large attendance, at all events by the number of papers set down each morning to be read, and by the length and interest of the discussions which the more important of these papers elicited.

Every year the advantage of these autumnal meetings becomes more and more apparent. The value does not, however, arise from a diligent attendance at the Sections, but from those impalpable influences which result from a lounge in the reception-room—a picnic or excursion to some place of note in the neighbourhood—a look in at the B.'s, the Red Lions, or the Eastern Club. Men, who before only knew each other in the pages of a scientific journal, here meet in friendly companionship, and the keen scientific antagonist becomes a personal friend for life. A controversy which has been dragging on for years is settled by ten minutes' personal explanation; and opponents who were rapidly approaching the orthodox scientific intensity of hatred, carry away from such a meeting mutual forbearance and respect. These are precious results, and if the Sections are of no other use, they have the inestimable advantage of drawing men of kindred pursuits together from all parts of the kingdom, and giving them an excuse for a week's holiday under the convenient pretence of attending a scientific meeting.

The liberality extended to visitors by residents in the neighbourhood has been unbounded, every mansion having been full of guests. Lord Kinnaird has shown especial hospitality to the frequenters of Section B, and amongst the chemists staying at his seat—Rossie Priory—have been Dr. Angus Smith, Mr. Crookes, Mr. Spiller, and Mr. Ansell, the inventor of the fire-damp indicator.

Last week I mentioned that the reports of the Council and of the Parliamentary Committee had been presented to the Association. These contain some remarks which cannot fail to interest those readers of the Chemical News who are advocating the introduction of scientific education into schools. At the last meeting of the Association, the committee of recommendations referred to the Council certain resolutions which had been adopted by the committees of two sections relative to the teaching of natural science in schools. The Council, fully impressed with the importance of the subject, appointed a special committee for the purpose of enquiring into the question, and of preparing a report thereon. This committee consisted of the general officers of the association, the trustees, the Rev. F. W. Farrar, M.A., F.R.S., the Rev. T. N. Hutchinson, M.A., Professor Huxley, F.R.S., Mr. Payne, Professor Tyndall, F.R.S., and Mr. J. M. Wilson, M.A. The Council having considered the report presented by this committee, adopted the recommendations contained therein, and resolved that the report be submitted to the general committee at Dundee. These recommendations were given in our last number.

The Parliamentary Committee state that the attention of the public appears to have been awakened to the necessity for introducing scientific teaching into our schools, if we are not willing to sink into a condition of inferiority as regards both intellectual culture and skill in art, when compared with foreign nations. The voluntary efforts of the masters of two of our great schools to add instruction in natural science to the ordinary classical course are deserving of all praise; and some evidence of their success may be derived from the interesting fact—disclosed in the able report of the committee appointed by the Council of the Association to consider this subject—that some of the boys at Harrow have formed themselves into a voluntary association for the pursuit of science.

This has formed the subject of a special discussion in the Committee of Section B, who have recommended "that a committee be appointed to inquire into the present methods of teaching chemistry and physics in schools of various classes, and to suggest the best means of furthering it in accordance with the recommendations of the report."

I mentioned last week that a lecture was to be delivered on Thursday evening,

"*On Matter and Force.*"

By Professor Tyndall, F.R.S.

This lecture was not addressed to members of the British Association; but to working men, of whom nearly 3,000 were present, the large Kinnaird Hall being crowded to suffocation. To give the lecture at length would occupy more pages than can be well spared. I cannot refrain, however, from quoting some extracts from one of the most eloquent addresses which this gifted orator has ever delivered. The subject matter of the lecture offered no special interest to those who are in the habit of listening to this philosopher in his home—the Royal Institution, but not a word or experiment was lost upon the auditors, who testified their admiration of the noble and high-toned sentiments by silent rapt attention, and of the brilliant experiments by enthusiastic applause, occasionally so prolonged that the lecturer was obliged to beg them to moderate their cheering, or he should be obliged to extend the hour and a half allotted to him to two hours. Professor Tyndall's language is always elevated in tone, and his speculations bold and fearless; and those who listened to the climax of tumultuous applause which followed his splendid peroration, looked in vain for any evidence of that intolerance of free-thought which is supposed to be a national characteristic north of the Tweed.

Professor TYNDALL commenced by remarking on the avidity with which the working men of London seized the opportunities afforded them by the evening lectures delivered every year by the Professors in the Royal School of Mines. It was a noteworthy fact that these lectures were but rarely of a character which could help the artisan in his daily pursuits. It was a pure desire for knowledge, as a thing good in itself, and without regard to its practical application which animated these men.

"They wish to know," he continued, "more of the wonderful universe around them; their minds hunger for this knowledge as naturally as their bodies hunger for food, and they come to us to satisfy this intellectual want. It is easily argued as a plea for science that it affords great material benefits. So it does. No doubt of it. Without science your Dundee would be a very small place indeed. But still the scientific discoverers—those high priests, so to say, of Science—they are, I assure you, in this work very rarely actuated by a desire for practical application at all. Take that great man whose name I can hardly trust my lips to utter—that man whom I loved—and who has lately gone from this earth—that man Faraday. That man—a poor book-binder's apprentice—has done more for practical science than dozens of your practical men added together; and he has done it without ever caring to gain a shilling by it. He did it because he loved science; and I say it behoves the Legislature to know that the real workers in science are not those who are always trying to turn it to a practical account. They love science for itself, and their desire is to understand and know all the phenomena of this glorious universe.

Whether it be a consequence of long-continued development, or whether it be an endowment conferred once for all on man at his creation, we find him here gifted with a mind, curious to know the cause of things, and surrounded by things which excite its questionings, and raise the desire for an explanation. It is related of a young Prince of one of the Pacific Islands, that when he first saw himself in a looking-glass, he ran round the glass to see who was standing at the back. He wished to know the cause of what he saw. And thus it is with the general human intellect when it regards and ponders the phenomena of the external world. It wishes to know the causes and connections of these phenomena. What is the sun, what is the earth, what should we see if we came to the edge of the earth and looked over? What is the meaning of thunder and lightning, of hail, rain, storm, and snow? Such questions early presented themselves to men, and by and by it was discovered that this desire for knowledge was not implanted in vain. After many trials it became evident that man possessed the power of solving such questions—that within certain limits the secret of the universe was open to the human understanding. It was found that the mind of man had the power of penetrating far beyond the boundaries of his five senses; that the things which are seen in the material world depend for their action upon things unseen; in short, that besides the phenomena which address the senses, there are laws and principles and processes which do not address the senses, but which must be, and can be, spiritually discerned.

Now, there are two things which form, so to say, the substance of all scientific thought. The entire play of he scientific intellect is confined to the combination and resolution of the ideas of matter and force. Newton, it is said, saw an apple fall. To the common mind this presented no difficulty and excited no question. Not so with Newton. He observed the fact; but one side of his great intellectual nature was left unsatisfied by the mere act of observation. He sought after the principle which ruled the fact. Whether this anecdote be true or not, it illustrates the fact that the ordinary operations of nature, which most people take for granted as perfectly plain and simple, are often those which most puzzle the scientific man. To the conception of the matter of the apple Newton added that of the force that moved it. The falling of the apple was due to an attraction exerted mutually between the apple and the earth. He applied the idea of this force to suns and planets and moons, and showed that all their motions were necessary consequences of the action of this force of attraction. He proved that the planetary motions were what observation made them to be, because every particle of matter in the solar system attracts every other particle by a force which varies as the inverse square of the distance between the particles. He showed that the moon fell towards the earth, and that the planets fell towards the sun, through the operation of the same force that pulls an apple from its tree. And this all-pervading force, the conception of which was necessary to Newton's intellectual peace, is called the force of gravitation. All force may be ultimately reduced to a push or a pull in a straight line; but its manifestations are various, and sometimes so complex as entirely to disguise its elementary constituents.

Long thinking and experimenting on the materials which compose our world have led philosophers to conclude that matter is composed of atoms from which, whether separate or in combination, the whole material world is built up. The air we breathe, for example, is mainly a mixture of the atoms of two distinct substances, called oxygen and nitrogen. The water we drink is also composed of two distinct substances, called oxygen and hydrogen. But it differs from the air in this particular, that in water the oxygen and hydrogen are not *mechanically* mixed, but *chemically* combined. In fact, the atoms of oxygen and those of hydrogen exert enormous attractions on each other, so that when brought into sufficient proximity they rush together with an almost incredible force to form a chemical compound.

One consequence of the clashing together of the atoms is the development of a great amount of heat. What is this heat? How are we to figure it before our minds? I do not despair of being able to give you a tolerably distinct answer to this question. Here are two ivory balls suspended from the same point of support by two short strings. I draw them thus apart and then liberate them. They clash together, but, by virtue of their elasticity, they quickly recoil from each other, and a sharp vibratory rattle succeeds their collision. This experiment will enable you to figure to your mind a pair of clashing atoms. We have, in the first place, a motion of the one atom towards the other—a motion of translation, as it is usually called. But when the atoms come sufficiently near each other, elastic repulsion sets in, the motion of translation is stopped and converted into a motion of vibration. To this vibratory motion we give the name of heat. Thus, three things are to be kept before the mind—first, the atoms themselves; secondly, the force with which they attract each other; and thirdly, the motion consequent on the exercise of that force. This motion must be figured first as a motion of translation, and then as a motion of vibration; and it is not until the motion reaches the vibratory stage that we give it the name of heat. It is this motion imparted to the nerves that produces the sensation of heat.

It would be useless to attempt a more detailed description of this molecular motion. After the atoms have been thrown into this state of agitation, very complicated motions must ensue from their incessant collision. There must be a wild whirling about of the molecules. For some time after the act of combination, this motion is so violent as to prevent the molecules from coming together. The water is maintained for a time in a state of vapour; but as the vapour cools, or, in other words, loses its motion, the water molecules coalesce to form a liquid. And now we are approaching a new and wonderful display of force. No one who had only seen water in its vaporous or liquid form could imagine the existence of the forces to which I am now about to refer; for, as long as the sub-

stance remains in a liquid or vaporous condition, the play of these forces is masked by the agitation kept up by the heat among the molecules. But let the heat be gradually withdrawn, the antagonist to their union being removed, the molecules begin to form new combinations. Like the particles of iron in our magnetic experiment, the water molecules are endowed with attractive and repulsive poles, and they arrange themselves together in accordance with these attractions and repulsions. Solid crystals of water are thus formed, to which we give the familiar name of ice. To the eye of science, these ice crystals are as precious as the diamond—as purely formed, as delicately built. Where no disturbing causes intervene, there is no disorder in this crystalline architecture. By their own structural power molecules build themselves on to molecules with a precision infinitely greater than that attainable by the hands of man. We are apt to overlook the wonderful when it becomes common. Imagine the bricks and stones of this town of Dundee endowed with locomotive power. Imagine them attracting and repelling each other, and arranging themselves in consequence of these attractions and repulsions so as to form streets and houses and Kinnaird Halls; would not that be wonderful? No less wonderful is the play of force by which the molecules of water build themselves into the sheets of crystal which roof your ponds and lakes every winter. To use the language of the American poet, Emerson, "the atoms march in tune," moving to the music of law, which thus renders the commonest substance in nature a miracle of beauty to the mental eye. It is the function of science, not as some think to divest this universe of its wonder and its mystery, but, as in the case here before us, to point out the wonder and the mystery of common things.

Over a plate of perfectly clean glass I pour a little water in which a crystal has been dissolved. A film of the solution clings to the glass; and now I wish to make this film crystallise before your eyes. By means of a microscope and electric lamp, I throw an image of the plate of glass upon the screen. The beam of the lamp, besides illuminating the glass, also heats it; evaporation is thereby promoted, and, at a certain moment, when the solution has become supersaturated, splendid branches of crystals shoot out over the screen. A dozen square feet of surface are now covered by those beautiful forms. Here we have crystalline spears shooting over the screen, feathered right and left by other spears. Molecule thus closes with molecule, until, finally, the whole subsides into crystalline rigidity. I move a new portion of the film into the beam. From distinct nuclei in the middle of the field of view the crystalline spears shoot with magical rapidity in all directions. For a moment the whole film appears to be alive, and now it has sunk into molecular repose. The film of water on a window pane on a frosty morning exhibits effects quite as wonderful as these. Latent in this formless solution, latent in every drop of water lies this marvellous structural power, which only requires the withdrawal of opposing forces to bring it into action. These experiments show that the common matter of our earth—"brute matter," as Dr. Young calls it—when its atoms and molecules are permitted to bring into free play the forces with which they are endowed, arranges itself under the operation of these forces, into forms which rival in beauty those of the vegetable world. And what is the vegetable world itself but the result of the complex play of these molecular forces? Here, as elsewhere throughout nature, if matter moves it is force that moves it, and if a certain structure is produced it is through the operation of the forces with which the atoms and molecules composing the structure are endowed. These atoms and molecules resemble little magnets with mutually attractive and mutually repellent poles. The attracting poles unite, the repellent poles retreat from each other, and vegetable forms are the final expression of this complicated play of molecular force. In the formation of our lead and silver trees, we needed an agent to wrest the lead and the silver from the acids with which they were combined. A similar agent is required in the vegetable world. The solid matter of which our lead and silver trees were formed was, in the first instance, disguised in a transparent liquid; the solid matter of which our woods and forests are composed is also, for the most part, disguised in a transparent gas, which is mixed in small quantities with the air of our atmosphere. That gas is formed by the union of carbon and oxygen, and is called carbonic acid gas. Two atoms of oxygen and one of carbon unite to form the molecule of carbonic acid which, as I have said, is the material from which wood and vegetable tissues are mainly derived. The carbonic acid of the air being subjected to an action somewhat analogous to that of the electric current in the case of our lead and silver trees, has its carbon liberated and deposited as woody fibre. The watery vapour of the air is subjected to a similar action; its hydrogen is liberated from its oxygen, and lies down side by side with the carbon in the tissues of the tree. The oxygen in both cases is permitted to wander away into the atmosphere. But what is it which thus tears the carbon and the hydrogen from the strong embrace of the oxygen? What is it in nature that plays the part of the electric current in our experiments? The rays of the sun. The leaves of plants absorb both the carbonic acid and the aqueous vapour of the air; these leaves answer to the cells in which our experiments on decomposition by the electric current took place. In the leaves the solar rays decompose both the carbonic acid and the water, permitting the oxygen in both cases to escape into the air, and allowing the carbon and the hydrogen to follow the bent of their own forces. And just as the molecular attractions of the silver and the lead found expression in the production of those beautiful branching forms seen in our experiments, so do the molecular attractions of the liberated carbon and hydrogen find expression in the architecture of grasses, plants, and trees.

In the fall of a cataract or the rush of the wind we have an example of mechanical power. In the combinations of chemistry and in the formation of crystals and vegetables we have examples of molecular power. Before proceeding further I should like to make clear to you the present condition of the surface of the globe with reference to power generally. You have learned how the atoms of oxygen and hydrogen rush together to form water. I have not thought it necessary to dwell upon the mighty mechanical energy of their act of combination, but, in passing, I would say that the clashing together of 1 lb. of hydrogen and 8 lbs. of oxygen to form 9 lbs. of aqueous vapour, is greater than the clash of a weight of 1000 tons falling from a height of 20 feet against the earth. Now, in order that the atoms of oxygen and hydrogen should rise by their mutual attractions to the velocity corresponding to this enormous mechanical effect, a certain distance must exist between the particles. It is in rushing over this distance that the velocity is attained. This idea of distance between the attracting atoms is of the highest importance in our conception of the system of the world. For the world may be divided into two kinds of matter; or rather the matter of the world may be classified under two distinct heads—namely, of atoms and molecules which have already rushed together and thus satisfied their mutual attractions, and of atoms and molecules which have not yet rushed together, and whose mutual attractions are, therefore, as yet unsatisfied. Now, as regards motive power, the working of machinery, or the performance of mechanical work generally by means of the materials of the earth's crust, we are entirely dependent on those atoms and molecules whose attractions are as yet unsatisfied. Those attractions can produce motion, because sufficient distance intervenes between the attracting molecules, and it is this molecular motion that we utilise in our machines. Thus we can get power out of oxygen and hydrogen by the act of their union, but once they are

combined, and once the motion consequent on their combination has been expended, no further power can be got out of the mutual attraction of oxygen and hydrogen. Their mutual attractions are then satisfied, and as dynamic agents they are dead.

Now, if we examine the materials of which the earth's crust is composed, we find them to consist for the most part of substances whose atoms have already closed in chemical union—whose mutual attractions are satisfied. Granite, for instance, is a widely diffused substance; but granite consists, in great part, of silicon, oxygen, potassium, calcium, and aluminium, the atoms of which substances met long ago in chemical combination, and are therefore dead. Limestone is also a widely-diffused substance. It is composed of carbon, oxygen, and a metal called calcium. But the atoms of those substances closed long ago in chemical union, and are therefore dead. And in this way we might go over the whole of the materials of the earth's crust, and satisfy ourselves that though they were sources of power in ages past, and long before any being appeared on the surface of the earth capable of turning their power to account, they are sources of power no longer. And here we might halt for a moment to remark on that tendency so prevalent in the world, to regard everything as made for human use. Those who entertain this notion hold, I think, an overweening opinion of their own importance in the system of nature. Flowers bloomed before men saw them, and the quantity of power wasted before man could utilise it is all but infinite compared with what now remains to be applied. The healthy attitude of mind with reference to this subject is that of the poet, who, when asked whence came the rhododendron, replied—

> "Why wert thou there, O rival of the rose?
> I never thought to ask, I never knew,
> But in my simple ignorance supposed
> The self-same power that brought me there brought you."

A few exceptions to this general state of union of the particles of the earth's crust—all-important to us, but trivial in comparison to the total store of which they are but the residue—still remain. They constitute our main sources of motive power. By far the most important of these exceptions are our beds of coal, composed chiefly of carbon, which has not yet closed in chemical union with oxygen. Distance still intervenes between the atoms of carbon and those of oxygen, across which the atoms may be impelled by their mutual attractions; and we can do nothing more than utilise the motion produced by this attraction. Once the carbon and the oxygen have closed together, so as to form carbonic acid, their mutual attractions are satisfied; and while they continue in this condition, as dynamic agents they are dead. Our woods and forests are sources of mechanical energy, because they also have the power of uniting with the atmospheric oxygen, and the molecular motion produced in the act of union may be turned to mechanical account. And let it be remembered that the source of motive power here referred to is also the source of muscular power. A horse can perform work, and so can a man; but this work is at bottom the molecular work of the elements of the food and the oxygen of the air. We inhale this vital gas. We bring it into sufficiently close proximity with the carbon and the hydrogen of the food. They unite in obedience to their mutual attractions, and their motion towards each other, properly turned to account by the wonderful mechanism of the body, becomes muscular motion.

One fundamental thought pervades all these statements: there is one tap-root from which they all spring. This tap-root is the ancient maxim that out of nothing nothing comes; that neither in the organic world nor in the inorganic is power produced without the expenditure of other power; that neither in the plant nor in the animal is there a creation of force or motion. Trees grow, and so do men and horses; and here we have new power incessantly introduced upon the earth. But its source, as I have already stated, is the sun. For he it is who separates the carbon from the oxygen of the carbonic acid, and thus enables them to recombine. Whether they recombine in the furnace of the steam-engine or in the animal body, the origin of the power they produce is the same. In this sense we are all "souls of fire and children of the sun." But, as remarked by Helmholtz, we must be content to share our celestial pedigree with the meanest living thing. The frog, and the toad, and those terrible things, the monkey and the gorilla, draw their power from the same source as man.

Some estimable persons here present very possibly shrink from accepting these statements; they may be frightened by their apparent tendency towards what is called materialism—a word which to many minds expresses something very dreadful. But it ought to be known and avowed that the physical philosopher, as such, must be a pure materialist. His inquiries deal with matter and force, and with them alone. The action which he has to investigate is necessary action, not spontaneous action—the transformations, and not the creation, of matter and force. And whatever be the forms which matter and force may assume, whether in the organic world or the inorganic, whether in the coal beds and forests of the earth or in the brains and muscles of men, the physical philosopher will make good his claim to investigate them. It is perfectly vain to attempt to stop investigation as to the actual and possible combinations of matter and force. Depend upon it, if a chemist, by bringing the proper materials together, could produce a baby he would do it. And why not? There is no command forbidding him to do it—his inquiries in this direction are limited solely by his own capacity and the inexorable laws of matter and force. At the present moment there are, no doubt, persons experimenting on the possibilities of producing what we call life out of inorganic materials. Let them pursue their studies in peace; it is only by such trials that they will learn the limits of their powers.

But while I thus make the largest claim for freedom of investigation—while I as a man of science feel a natural pride in scientific achievement, while I regard science as the most powerful instrument of intellectual culture, as well as the most powerful ministrant to the material wants of men, if you ask me whether science has solved, or is likely to solve, the problem of this universe, I must shake my head in doubt. We have been talking of matter and force; but whence came matter, and whence came force? You remember the first Napoleon's question, when the *savans* who accompanied him to Egypt discussed in his presence the problem of the universe, and solved it to their apparent satisfaction. He looked aloft to the starry heavens, and said—"It is all very well, gentlemen, but who made all these?" That question still remains unanswered, and science makes no attempt to answer it. As far as I can see, there is no quality in the human intellect which is fit to be applied to the solution of the problem. It entirely transcends us.

The mind of man may be compared to a musical instrument with a certain range of notes, beyond which in both directions we have an infinitude of silence. The phenomena of matter and force lie within our intellectual range, and as far as they reach we will at all hazards push our enquiries. But behind, and above, and around all, the real mystery of this universe remains unsolved; and here the true philosopher will bow his head in humility, and admit that all he can do in this direction is no more than what is within the compass of an ordinary child. Fashion this mystery as you will, with that I have nothing to do. But be careful that your conception of the Builder of this universe is not an unworthy conception. Invest that conception with your grandest, and highest, and holiest thought, but be careful of pretending to know more about it than is given to man to know. Be careful, above all things, of professing to see in the phenomena of the material world the evidences of Divine pleasure or displeasure. Doubt this all ye who would deduce from the fall of the Tower of Siloam, the sin and wickedness of

those who were crushed by the fall! Doubt this all ye who pretend to see in cholera, cattle plague, and bad harvests, the evidence of Divine anger! Doubt this—— but it requires some courage to say these things in Scotland—all ye who assert that the depreciation of railway scrip is a consequence of railway travelling on Sundays. You know nothing about it. To such I say in substance, what was said by one of the mightiest Scotchmen living or dead—Thomas Carlyle—to the followers of Dr. Pusey—

"The Builder of this universe was wise,
He formed all souls, all systems, planets, particles;
The plan he formed his worlds and Æons by,
Was—Heavens!—was thy small nine-and-thirty articles!"

I now resume my report of the proceedings.

Section B. Chemical Science.

Friday, September 6th.

The following papers were read:—

"*On the present use of Lichens as Dye Stuffs.*"

By Lauder Lindsay.

In the absence of the author this paper was read by Dr. Odling. He said—It had been expected that the aniline dyes—a product from the distillation of coal tar—discovered a few years ago, would supersede the lichenous dye stuffs previously in use, and that the latter would speedily disappear, in consequence of the breaking up of the Highlands by railways—and the improvement of the communication between Glasgow, Edinburgh, and the south. To him, however, it seemed that all such predictions were at least premature. He confessed that such was the eminence and experience of the authorities, that for a time he acquiesced in their conclusions, and took it for granted that they were well grounded; but in the course of his investigations for a work which he had in preparation on lichenology, he had found that there existed abundant evidence of the use of lichens in commercial manufactures on a large scale, as well as for domestic purposes. Dr. Lindsay then stated that from facts which he had learned at the Exhibition of 1862, from his investigations while on a tour through the Orkney and Shetland Islands, and parts of the Highlands, and from numerous writers whom he quoted, he had come to conclusions favouring the belief that lichens would not be superseded, at least for a long time to come. He then proceeded to give numerous details of the use of lichen dyes for commercial and domestic purposes, to remark on the unsatisfactory state of the nomenclature and classification of the lichens, and to advocate a uniform system.

"*A Note on Messrs. Wanklyn, Chapman, and Smith's Method of Determining Nitrogenous Organic Matters in Water,*"

By Dugald Campbell, F.C.S.

At the last meeting of the Chemical Society, June 20th, Professor J. A. Wanklyn read an extract from a paper by himself, Mr. E. T. Chapman, and Mr. M. H. Smith, "*On Water Analysis, and the Determination of Organic Matter in Water,*" in which they proposed a mode of estimating the amount of nitrogenous matter contained in water, whether it exists as ammonia, or urea, or as albuminous matter; a report of this is given in the Chemical News of July 5, p. 7.

Having for a number of years worked specially on the estimation of nitrogen in solutions containing ammonia, urea, and albuminous matters, I was much struck with the results which were given by these gentlemen, and at the time when the paper was read I expressed my doubts as to the accuracy of their observations, my own having been so diametrically opposite; still, although nothing was said on the reading of the extract about the actions being different with *moderately strong* and *very dilute* solutions, yet after my remarks something was said by one of the gentlemen (Mr. Chapman) in the discussion about strong solutions requiring different treatment; and remembering that my experiments had all been made upon what might be termed moderately strong solutions, certainly not very dilute solutions, I was silent, as I thought this might possibly account, at least to some extent, for the great differences in our results; still I did not think this could wholly account for them.

Since then, however, I have made a number of experiments with very dilute solutions of both urea and albumen, the results of which in a great measure, if not entirely, confirm my views stated at the time, viz. that urea is not perfectly decomposed by distilling with sodic carbonate as described by these gentlemen, and likewise that I had invariably detected ammonia in the distillate from a solution of albuminous matter when it was distilled under similar circumstances.

As regards the first part of the process, which is the estimation of ammonia in the water, and which is in my opinion a very material one, but which appears to me to have been passed over by these gentlemen as a thing of very little importance, all we are told of it is that "when the quantity of ammonia present in the original water is large it is determined directly, unless the water is too much coloured." In all the experience which I have had in determining the amount of ammonia in water by Nessler's test, working on the usual scale, I have never been able to apply it with any degree of accuracy to the original water, but always had to distil the water with some alkali and test the distillate; and this I know is the general experience; and if urea is so readily broken up in the distillation of water, as it is said to be by these gentlemen, I should have thought that some means of distilling the water in order to obtain from it the ammonia, without decomposing the urea, should have been given, and that a process for estimating the ammonia, urea, and albuminous matters in water would scarcely be complete without it.

After the determination of the ammonia, the next operation, we are told, is to introduce a litre of the water "into a retort with two grammes of sodic carbonate, and rapidly distil, the distillate being collected in a flask containing 100 c.c. When this is filled the receiver is changed, and another 100 c.c. distilled off; this is repeated a third time, and it is now found that all the nitrogen present in the original water, in the form of urea, has passed over in the form of ammonia. The ammonia in the distillate is then determined by Nessler's test."

I may state that in Parliament, and generally throughout the kingdom, when reports are made upon the analysis of waters, the results are required to be given in grains, or parts of a grain, in a gallon of the water of 70,000 grains at 60° Fahrenheit, and they are thus much more readily understood by engineers and the public generally, who are interested in these matters, than when otherwise expressed. I have, therefore, in the following experiments thought it best to state that the waters operated upon contained so many parts of a grain of the substance being experimented upon per gallon, and also to use grains in making the solutions in other parts of the experiments; but I have retained the litre and cubic centimeter measures, as I wished to follow explicitly the experiment as it is given above, as to the quantity of water taken for distillation and the amount of each of the distillates, in case anything might be said of my not having done so.

The first experiments were made with a solution of urea equal to the $\frac{1}{30}$th part of a grain of urea in a gallon of water, Prof. Wanklyn having given this as a quantity by which his process could be tried, and with which he said it would work satisfactorily, as it had been described in their paper. The following are the details and results :—

A litre of water was taken in which was dissolved an amount equal to 0·011 grain of urea containing the elements of 0·0062 grain of ammonia, and introduced into a retort capable of holding twice this quantity. 30·87 grains (two grammes) of sodic carbonate were then added, and the distillation was proceeded with rapidly, and the distillate collected exactly as described above. The ammonia which was found only in the two first 100 c.c., and estimated by Nessler's test, gave 0·0026 grains, or about one-third of the ammonia present in the urea taken.

There being no trace of ammonia in the third 100 c.c., I should from the statements of Messrs. Wanklyn, Chapman, and Smith, have concluded that all the urea was decomposed into ammonia, had I not known the quantity of urea which was taken at the outset, and also from my former experiments upon stronger solutions of urea which acted very similarly; but knowing this, a solution of potassic hydrate was introduced into the retort, and the distillation proceeded with exactly as before described ; the two first 100 c.c. which were distilled over, contained 0·002 grains of ammonia, and the third distillate containing no ammonia ; potassic permanganate was added in crystals to the liquid in the retort until it was deeply coloured, and the distillation was again proceeded with as above ; the remainder of the ammonia, which was estimated at 0·0015 grain, was in the first and second, but principally in the first 100 c.c., and none in the third. Altogether the ammonia obtained was 0·0061 grain, the calculated quantity being 0·0062 grain.

This experiment was repeated as above described, but with somewhat different results, the distillations with the sodic carbonate giving 0·0021 grain, the potassic hydrate 0·0016 grain, and the potassic permanganate 0·0025 grain, altogether 0·0062 grain of ammonia, which is exactly the quantity of ammonia in the urea taken.

Experiments were next made with a solution of urea equal to $\frac{1}{3}\frac{1}{0}$th part of a grain of urea in a gallon of water, and the following are the details and results :—

A litre of water was taken in which was dissolved a quantity equal to 0·0055 grain of urea, containing the elements of 0·0031 grain of ammonia, and distilled as above with sodic carbonate ; in the first two 100 c.c. the ammonia present amounted to 0·001 grain; in the third 100 c.c. there was no ammonia; potassic hydrate gave in the first two 100 c.c. 0·001 grain of ammonia, in the third none, and potassic permanganate gave in the first two 100 c.c., but principally in the first, 0·0011 grain of ammonia, making altogether 0·0031 grain of ammonia, which is the exact quantity of ammonia in the urea taken.

This experiment was repeated exactly as above, but, as in the former case, with slightly different results ; sodic carbonate gave 0·001 grain, potassic hydrate gave 0·0001 grain, and potassic permanganate 0·002 grain ammonia, making altogether 0·0031 grain of ammonia.

Experiments were next made with a solution of urea equal to $\frac{1}{6}\frac{1}{0}$th part of a grain of urea in a gallon of water, and the following are the details and results :—

A litre of water was taken, in which was dissolved an amount equal to 0·0025 grain of urea, containing 0·00155 grain of ammonia, and treated in the same manner as in the preceding experiments ; with sodic carbonate it gave 0·0013 grain ammonia in the first two 100 cc., and no ammonia in the third ; with potassic hydrate 0·0001 grain in the first two 100 cc., and none in the third ; and with potassic permanganate, gave 0·0001 grain of ammonia ; altogether within a fraction of the amount of ammonia in the urea employed.

This experiment was repeated, and the results were as follows :—With sodic carbonate, 0·0008 grain, with potassic hydrate 0·0003 grain, and with potassic permanganate 0·0004 grain ; altogether 0·0015 grain of ammonia, and making the same amount of ammonia as the last, but evolved differently.

Experiments were next made with a solution of urea equal to the 100th part of a grain of urea in a gallon of water, and the following are the details and results :—

A litre of water was taken in which were dissolved 0·0022 grain of urea containing 0·00136 grain of ammonia, and distilled as above; with sodic carbonate in the first two 100 c.c. there were 0·001 grain of ammonia, and no ammonia in the third 100 c.c. ; and by potassic hydrate in the first two 100 c.c. 0·0003 grain ; whilst by potassic permanganate there was no ammonia. The ammonia distilled off was altogether 0·0013 grain, which is a fraction less ammonia than was contained in the urea employed.

This experiment was repeated with a nearly similar result.

Experiments were next made with a solution of urea equal to the $\frac{1}{2}\frac{1}{0}$th part of a grain of urea in a gallon of water, and likewise with still smaller portions of urea, when it was found in all cases that with sodic carbonate all the ammonia contained in the urea distilled over in the first 100 c.c.

From these experiments it would appear that urea is decomposed entirely when distilled in the ordinary manner with sodic carbonate, but only when in extremely dilute solutions ; requiring the assistance of potassic permanganate to decompose it even when so dilute as in the proportion of the $\frac{1}{8}\frac{1}{0}$th part of a grain of urea in a gallon of water, or one part in five millions ; and requiring the assistance of potassic hydrate to decompose it even when diluted to an extent above one part in seven millions ; and that is only decomposed by sodic carbonate alone when diluted somewhat above this point.

I may add that these and all other experiments were made with distilled water, which tried in every way showed not a trace of ammonia by Nessler's test, and that every experiment was made by dissolving at the time fresh crystals of urea; or, in other words, that no solution of urea was employed which had been made or kept any time. I may also add that I found a considerable difference in the various specimens of urea which I examined ; all gave distinct indications of ammonia by the Nessler test ; the larger, less coloured, and finer the crystals the more was the ammonia. I need scarcely add that working upon such very dilute solutions as I was doing, the latter specimens yielded sensibly more ammonia by the sodic carbonate and potassic hydrate than those showing less indications of ammonia by the Nessler test ; still I do not doubt that working with any ordinary urea, the results will not be far different from my own, although variable.

The next part of the process to which I wish to call attention is the estimation of what is termed the "albuminous substances."

According to Messrs. Wanklyn, Chapman, and Smith, albumen, such as from white of egg, yields no ammonia, ascertained by Nessler's test, when a solution of albumen is distilled with the proportions of sodic carbonate, 30·87 grains (2 grammes), which they say they use to decompose the urea ; whereas, as I stated before, in all my experiments I had invariably found that ammonia was evolved under such circumstances. I may observe that hitherto my experiments had been made upon what might be termed rather strong solutions (one grain of dry albumen in a gallon of water), and hence I was led to make the following experiments with what I conceive to be weak solutions :—

The first experiment was made with a quantity about equal to the $\frac{1}{2}\frac{1}{0}$th part of a grain of dry albumen to 1 gallon of water.

100 grains of the white of new-laid eggs, dried, gave 12·00 grains of dry residue containing 1·884 grains of ammonia; or 100 grains of such white of egg contained 1·884 grains of ammonia.

A litre of water was taken in which was dissolved an amount equal to 0·093 grain of white of egg containing 0·00175 grain of ammonia, and was distilled with 30·87 grains (2 grammes) of sodic carbonate; in the two first 100 c.c. of the distillate 0·0006 grain of ammonia were estimated by Nessler's test, in the third 100 c.c. there was not a trace of ammonia; potassic hydrate was then added, and the distillation was gone on with as before, when not a trace of ammonia was discovered in any of the three 100 c.c. distilled; potassic permanganate was then added, and the distillation proceeded with, when it gave, principally in the first distillate, 0·001 grain of ammonia. Altogether there was a loss of 0·00015 grain of ammonia in the albumen.

This experiment was repeated with somewhat similar results, only rather more ammonia was evolved by the sodic carbonate, and again none by the potassic hydrate, and the remainder by the potassic permanganate.

The next experiment was made with about $\frac{1}{10}$th part of a grain of dry albumen to a gallon of water, as follows:—

A litre of water was taken, in which was dissolved an amount equal to 0·0466 grain of white of egg, containing 0·00087 grain of ammonia, and distilled with the sodic carbonate. The two first contained 0·0007 grain of the ammonia; potassic hydrate gave no ammonia in any of the three 100 c.c., and potassic permanganate gave 0·0001, which is a loss of 0·00007 of a grain of the ammonia contained in the white of egg employed.

Another experiment was made with a quantity equal to the $\frac{1}{20}$th part of a grain of dry albumen to a gallon of water, as follows:—

A litre of water was taken in which was dissolved an amount equal to 0·0233 grain of white of egg, containing 0.000435 grain of ammonia, and distilled with the sodic carbonate, the first two 100 c.c. gave 0·0002 grain of ammonia. By the potassic hydrate no ammonia was given off, and by the potassic permanganate 0·0002 grain, showing altogether a loss of ammonia equal to 0·000035 grain.

Another experiment was made with a quantity about equal to the $\frac{1}{180}$th part of a grain of dry albumen to a gallon of water, as follows:—

A litre of water was taken in which was dissolved 0·01165 grain of white of egg, containing 0·000217 grain of ammonia, and distilled with the sodic carbonate. In the first two 100 c.c. of the distillate all the ammonia was evolved, in the third 100 c.c. there was none, nor when distilled with potassic hydrate or potassic permanganate was there a trace to be found.

This experiment was repeated and with the same results, all the ammonia being evolved in the first two 100 c.c. when the solution was distilled with sodic carbonate alone.

In all these experiments it will be seen that with the sodic carbonate a distinct quantity of ammonia is evolved, and likewise that in all these experiments, strange though it may appear, after the ammonia has been evolved as far as is possible by the sodic carbonate, that potassic hydrate evolves not even a trace, and it is only on the addition of potassic permanganate that the final quantity of nitrogen is expelled as ammonia. It will likewise be seen that, as in very dilute solutions of urea, all the nitrogen is expelled as ammonia by the sodic carbonate, so likewise this is the case in very dilute solutions of albumen.

The whole of the above experiments, both with the urea and the albumen, were conducted in ordinary retorts of not less than twice the capacity of the liquid to be distilled, and as nearly all alike in shape and size as it was possible to get them, and every endeavour was made to distil the solutions at a rapid speed and as nearly under the same circumstances as possible, otherwise I do not think the results obtained would have been so regular as they are, but as far as I can judge from other experiments quite the reverse; still on the whole they would be generally confirmatory of the results I have obtained.

Since making these experiments, my attention has been directed to a paper by Mr. Chapman, "on Nessler's test for Ammonia," wherein that gentleman says that in comparing a solution to be tested with the ammonia standard, after adding the test he allows the liquids to stand for ten minutes before he compares them. My own experience, and I know it is that of others, is that this time is not nearly sufficient to develope the colour properly, and this is especially the case with very dilute solutions of ammonia; that being so I do not see why such solutions should not be allowed to stand until the colour is fully developed in them, although it make take a longer time, in which case experience has taught us that the results are a deeper and more defined colour, which admits of better, I might almost say, of perfect comparison. In carrying out the above experiments sufficient time was invariably allowed for the proper development of the colour when determining the amount of ammonia in all of the distillates.

"*A Description of a New Ether Anemometer.*"

By Alfred E. Fletcher.

Government Inspector of Alkali Works for the Western District.

The construction of this apparatus is based on the fact that a current of air passing across the open end of a straight tube causes a partial vacuum in it.

An application of this principle is seen in a small toy in common use, in which a liquid is made to ascend several inches in a vertical tube, by blowing through another tube across its open end. It rises by virtue of the partial vacuum caused by the current of air which crosses it.

If then a straight tube is inserted through a hole in the brickwork of a chimney or flue, so that the current of air in the flue passes across its open end, a partial vacuum will be formed in it, greater or less in proportion to the velocity of the current.

A tube in such a position will, however, communicate a suction arising from that of the chimney itself, besides that suction produced by the current of air passing across its open end, and for the present purpose these two must be distinguished.

To effect this *two* tubes should be inserted in the chimney, one of them having a straight and the other a bent end, the bend to be turned so as to meet the current of air; both tubes are open. In each of these tubes will be experienced the partial vacuum due to the suction of the chimney itself. In the straight tube, however, this will be increased by the suction caused by the passage of the current of air across its open end, while in the case of the bent tube this will be diminished by the pressure caused by the current of air blowing into it. The difference therefore between the suction in the two tubes will be due to the action of the current of air in the chimney, and it remains only to measure this difference in order to measure the velocity of the current itself.

To effect this let these tubes be connected with a U tube containing water, one with each limb; then the water will be raised up in one limb to a degree corresponding with the difference of suction, so that the difference of level of the water in the U tube, being a measure of the difference of suction in the tubes, becomes a measure of the velocity of the current of air in the chimney. By this arrangement the suction power of the chimney itself is eliminated, for it operates equally on each limb of the U tube, while the difference of pressure

experienced will be due only to the different action of the current of air in the flue on the tube with the straight end and the one with the bent end.

It remains, then, to register accurately this difference of level of the water in the U tube, and to construct a formula connecting it with the speed of the current of air in the flue, so that by measuring the one the other may be measured also.

Experiment showed that for high speeds of air the measurement of the difference of this water level was easy, but that for speeds below 5 feet per second the amount became too minute and uncertain for practical use.

Many plans were then devised for constructing a pressure gauge which should be more delicate than the ordinary U tube.

Efforts were first made to modify the U tube so that its range might be increased and its indications magnified. This might be done by drawing out its lower bend horizontally and increasing the size of the vertical portions till it assumed the form of two vertical cylinders connected by a long horizontal tube. If now a pressure were exerted which would cause a depression of the water in one limb, the motion so caused in the narrow column of water in the horizontal tube would be so much greater, as its sectional area was smaller, than that of the vertical tubes. It was found, however, that in proportion as a greater range in the scale of the instrument was thus obtained, a greater amount of friction must also be encountered, and that thus the advantage of the one was neutralised by the evil of the other.

It is necessary to see this clearly in order to arrive at the conclusion that *all* methods of increasing the actual motion of the fluids or of magnifying it by any mechanical arrangement of levers or otherwise, must be open to the same objection. This proposition seems clear now, in the light shed by a long series of failures encountered in the attempt to act contrary to it, but it was not clear before.

The simple U tube was therefore returned to, and means adopted for accurately seeing and measuring its slightest indications. In the first place, the limbs were increased until they were no longer small tubes of about 0·4 inch internal diameter, but cylinders of 4 inches diameter; these were connected at the bottom by a small tube. Thus the power exerted by the pressure communicated through the connecting tubes, operating on the extended surface of the liquid in the cylinders, was increased a hundredfold over that operating in the smaller U tube; but the friction could only have been increased tenfold, giving therefore a tenfold increase of delicacy. In order to observe accurately the rise and fall of the liquid in the cylinders floats were introduced, on each of which was engraved a very fine horizontal line; and to measure accurately the comparative elevation or depression of these two lines, a finely divided scale and vernier were added, working with a delicate screw adjustment. With this it is possible to measure an elevation or depression of $\frac{1}{1000}$ inch, which is sufficiently accurate for the purpose in view.

On trying now to apply the instrument so constructed, and attempting to measure very minute variations of pressure, failure still seemed imminent; for although the motion of the water in the increased limbs of the U tube could be measured to $\frac{1}{1000}$ inch, the water refused to move, except under pressures exceeding that which would be indicated by so small a column; in other words, the water seemed to stick in the cylinders. It was necessary, therefore, to make experiments with various liquids in order to choose one more suitable than water; for this purpose a very thin plate of metal was suspended from the beam of a delicate balance, and the amount of power required for its immersion in, and subsequent withdrawal from, various liquids thus measured. This resistance is due to what is often called capillary attraction and repulsion; it is shown to exist largely in water, by the fact that a needle may be made to rest on its surface without sinking. In the case of water 20 grains were needed to overcome it, while with many other liquids a much less force sufficed, and in the case of ether $\frac{1}{100}$ grain was sufficient. Ether was, therefore, chosen as the liquid which offered the least resistance, and also on account of its low specific gravity.

After substituting ether for water, the action of the manometer was quite satisfactory, the lines on the floats always return exactly to their original position after any disturbance, and its indications could be relied on to $\frac{1}{1000}$ inch.

It remained now to ascertain the value of these indications when applied to the measurement of the velocity of air.

Calculation might lead to this, but it was thought much better to depend, if possible, on actual experiment, and by testing the instrument with currents of air of known velocity to draw up a table for future use.

The following plan was adopted and found perfectly successful:—

A flue 14 inches diameter, 100 feet long, was constructed of iron pipes, one end was connected with the base of a high chimney, the other left open. A sliding plate of metal, capable of cutting off the connection between the chimney and the flue, served to regulate at will the amount of air drawn through it. At the open end of the flue a red-hot brick was placed, and on it was thrown at stated times a few drops of sulphuric acid. This raised instantly a dense cloud of white vapour, which, passing along the flue, could be observed to reach the other end, by looking through two holes bored through opposite sides of it. It remained now only to note the time occupied by the passage of the cloud of vapour along the flue to know the speed at which the air was passing through it. At the same time the tubes in connection with the ether manometer were in the flue and under the influence of the same current of air, so that the simultaneous reading of the instrument could be taken. By now altering the position of the slide which regulated the admission of air to the flue, the speed from time to time was altered, and a corresponding observation by the manometer obtained.

By the aid of this ether manometer the speed of any current of air in flues or chimneys can be measured by simply boring a hole one inch diameter through the brickwork and inserting two tubes, one with a bent, the other with a plain straight end as already described, and making the necessary observation of the floats; and in this operation neither soot, heat, nor corrosive vapours can prove any hindrance.

So sensitive is the apparatus that on a windy day the effect of each successive gust of wind is observable, as it causes variations in the draught of the chimney.

The instrument may be used as a wind gauge by fixing through the roof of an observatory a small vertical pipe, presenting a plain open end to the wind. The lower end of this pipe brought down into the observatory and connected with the ether manometer would communicate the varying pressures due to the varying speed of the wind.

"*On an Apparatus for Indicating the Presence and Amount of Fire-damp in Mines.*"

By George F. Ansell.

The idea embodied in the apparatus was founded on the law of diffusion announced by Mr. Graham, that gases diffuse in the inverse proportion to the square root of their densities, or, more popularly, that light gases diffuse more rapidly than heavy ones. Mr. Ansell showed, by experiment, that when a tube closed at one end by plaster of Paris was filled with common coal gas, the lighter part of the compound was rapidly diffused through the plaster, as

was at once seen by the yellow flame and slight explosion which ensued on bringing a lighted match close to the closed end. Hence, Mr. Ansell said, his proposition. In a pit the case is the reverse of that of the tube. There the gas is ready to escape into the galleries, and the apparatus must therefore be modified to suit the varying circumstances. The essential parts of the apparatus may be described as consisting of an alarm bell and a telegraph needle—the former being rung and the latter deflected by an electric current, which was set in motion by the action of the dangerous gas. The means by which this was effected consisted of an iron cup, on which was fixed a disc of white Sicilian marble, standing on a U-tube, which contained a quantity of mercury. The marble here represented the plaster which closed the end of the tube in the first experiment, and through it the dangerous gas was diffused. As it did so, the mercury was pressed up into the other extremity of the tube, completed the previously broken circuit, and an alarm was given by the ringing of the bell and the deflection of the needle.

Mr. Ansell proceeded to say that in coal-fields there are many casualties—including the bulk of the accidents arising from explosion,—caused by a sudden irruption of fire-damp (carburetted hydrogen), to such an extent as to render the atmosphere in even a mile of space explosive in a few minutes, and there are cases on record where an enormous space has been so polluted in a few seconds; but the common event is to find that a fall of roof, or the breaking in of a thin part of the sides or floor of a gallery, liberates an amount of gas which by mixture with the ordinary air of the pit renders the whole explosive. This mixture travels on slowly with the ventilation till it meets a light, and possibly an hour after its first formation destroys many lives. A source of great danger is that state of the pit which arises from the gradual bleeding of gas from coal. As one walks in a pit, one hears a continual "click," somewhat like the noise of a cricket. In some pits this may arise from the settling down of the strata and cracking of the coal, but the experienced ear soon knows the difference. Should any obstruction arise to the ventilation this bleeding very gradually raises the atmosphere from zero (the point of purity) to the point of explosion, or it may be that a gradual fall of the barometric pressure admits of the oozing out of gas either from a goaf, or from the mass of coal, and this, although minute, may be to such an extent as to render explosive the whole air of the pit if the ventilation be not very good. There are parts of a pit where gas may be so accumulated in half-an-hour, others where it may be two hours, and again others a whole day in rising to a dangerous mixture.

It is no uncommon thing to find thirty per cent of gas next the roof, at six inches below twenty per cent, and at fifteen inches no gas at all. I propose to fix the instruments * side by side, one for *sudden* and the other for *slow* accumulations, in pigeon-holes cast in iron posts, such as are used to support the roof, and to be used in addition to the ordinary supports for no other purpose than to carry the indicators, the pigeon-holes being clear all through, so that the gas can surround or sweep over the instruments while they are thus perfectly protected from falling substances; for the gas as it occurs in the pits is very curious in its habits, and from causes too minute to enumerate here, it "goes away" from a spot with very little disturbance. The pigeon-holes being formed in iron posts would protect the instruments from falling roof, &c., while grooves may be cast in the sides of these posts for the telegraph wires. It has been objected to by some that these instruments would cause greater destruction of life than now obtains, but these persons forget that my instruments are not intended to displace other means of safeguard. They are simply proposed as additional means of knowledge.

* These instruments were fully described in the CHEMICAL NEWS, vol. xv., p. 13.

For the indication of carbonic acid I make a necessary alteration, which will be seen in the figure:—

This hardly needs description, for it will be seen at a glance that the current is completed by the rising of the mercury to the wire within the precincts of the closed chamber, formed by the neck of the funnel, and is adjusted for use by turning the base on which it stands, when a cork rises against a leather bag and presses the mercury up to the required height. Whether marble will stand for a long period in contact with carbonic acid, and without disintegration, has to be determined; if not, I can replace it by another septum. This instrument is proposed for use in those mines where carbonic acid becomes a dangerous substance for the miner. It has been sought by the French vine growers as a means of telling the time of the commencement of fermentation, and it seems probable that the English brewers will use it for a similar purpose.

In the event of fire-damp being known to exist, either when found by the fixed indicators or by the safety lamps, I propose for the use of the miner, the manager, or his deputy, an aneroid indicator, which is not intended for the *detection of gas in the pit*. The intention of this particular instrument is that it shall be used to determine the amount per cent of fire-damp or carbonic acid where they are known or suspected to exist; and for these purposes it must be used in rigid accordance with the instructions given with it, not according to the fancy of the user, or as *he thinks it should be used*.

It must be mentioned that the same amount per cent of fire-damp in different mines requires a varying time for diffusion through the same tile. The cause of this is not known, but it is under investigation. This variation is from 45 to 60 seconds; but in the same pit it is invariably of a uniform time, so that, once determined, there is no trouble. That this is a property of the gas, is proved by the fact that 10 per cent of gas in one pit will explode violently, while 10 per cent in another explodes with much less violence. The underviewers call one a sharp gas and the other a slow gas, and the appearance is perfectly well marked if observed for a few times in the Davy lamp.

A mine, to be well ventilated, should be so supplied with air that a considerable eruption should be detected below the point of explosion. Ventilation which is only sufficient for ordinary occasions must be considered entirely insufficient. The Act of Parliament at present in force specifies that the working places shall be so ventilated as that "under ordinary circumstances" they shall be "in a fit state for working passing therein." This clause of the Act should be altered, and the Act should specify that five per cent of fire-damp should be the maximum ever permitted to attain, because seven and a half per cent is the minimum explosion point, and five is two-thirds of seven and a half, which is surely as near as could be allowed with safety.

It has been objected that my instruments are too delicate for use in the pits—that, in fact, they demonstrate the existence of so small an amount of gas as to

render their adoption a probable source of trouble by "showing the presence of 1½ per cent of fire-damp, and thus causing alarm, while that amount is actually harmless." To this objection I would reply that I have made my instruments so delicate, because in their former state it was objected that they would not show *small quantities*—that is smaller quantities than could be detected by the safety lamps now in use. But this objection has no weight, because the instruments, although capable of being so delicately set, need not be so adjusted unless by the will of the responsible person. I prefer that they should be so adjusted as to give warning only when the quantity of gas present reaches the limit of the minimum explosion point; still I would urge that the fact of an instrument showing small quantities as well as large does not necessarily render it valueless.

When I was permitted to exhibit and explain my instruments in committee-room D of the House of Lords, Mr. J. M. Day inspected them, and in behalf of the Mining Association of Great Britain, he made to me the following proposition :—"That I should make experiments in the coal pits he would select, and if my instruments would effect what I said they would do, they would prove to be very valuable and would be adopted—if, on the other hand, they failed in such trials there would be an end of the matter."

In accordance with this suggestion I visited such pits as Mr. Day appointed, and which he purposely selected, that I might meet every variety of circumstance. My experiments were admitted to be successful. I have just (between 26th August and 1st September) completed an exhaustive series of experiments in the Monkland pits at Airdrie, and Mr. Murray gives me permission to say that he has satisfied himself that my indicator is practicable and reliable.

From facts within my own knowledge, I have reason to believe that one of the reasons why my instruments are not adopted is, that the colliers would not go down the pits or remain at work if it were demonstrated to them that there was a dangerous accumulation of fire-damp. That the men have fear of fire-damp is demonstrated by the fact that the bench of magistrates of Wednesbury did, on the 2nd November, 1866, convict and sentence to fourteen days' imprisonment three colliers for refusing to work in a coal mine because the said mine was full of fire-damp. Yet the owners took no measures to prove to the men the absence—thus admitting the presence of fire-damp, but contented themselves with the statement that the complaint of the men, although supported by witnesses, was an excuse for a holiday. I am of opinion that coal-owners and their agents will not voluntarily adopt any new proposition, they having for years blindly ignored the Davy lamp, and they still refuse in a very great measure to adopt safety-cages, safety-hooks to prevent overwinding, and the necessary number of ventilating shafts, abiding only just inside the law of the land.

I wish to remark that the state of the barometer *does not* give warning of the irruption of fire-damp till some hours *after* it has taken place; and in such cases mining engineers admit that an instrument would be of real service.

While the French have offered considerable prizes for the invention of means devised for the saving of *life* in mines, English mine owners have contented themselves with offering prizes for coal cutting machines devised only for the saving of *labour*, but I humbly submit that if I am right in my supposition that my instruments are calculated to save life, they ought to be adopted, and all I ask is that they should be fairly tried. I am permitted to refer enquires to Mr. F. Murray, Monkland House, Airdrie, who has some of these instruments in his pits, and who will kindly exhibit them in action.

In consequence of a wish expressed by Francis Murray Esq., Monkland House, Airdrie, I sent him some instruments that he in my absence might form an opinion as to the practical value of my indicators, and that the colliery people, workmen as well as officers, might find out any objections to the instruments. Mr. Murray, in a note to me, says:— . . . . "the instrument was carried into the suspected places and put on the top of a post close to the roof of the working, in less than a minute after the connection was made the bell rang, the aneroid, (a pocket indicator) at the same spot indicating 45 per cent of gas. . . . . I allowed the bell to ring for about a minute and then screwed up the screw until it ceased to touch the mercury, in less than a minute the alarm sounded again; I screwed up again with the same results until the screw would go no further. Mr. Murray then placed the instrument "on the floor where the aneroid indicated no fire-damp . . . re-adjusted the mercury, and repeated the above experiments with the same results."

"I then by means of the aneroid ascertained the heigh at which 7½ per cent of gas was present, and then the alarm sounded in about five minutes. I then got all the gas driven out of the place, the aneroid indicating nothing at any height, and fixed the syphon at the height which formerly contained 7½ per cent of gas. In one hour the alarm bell sounded. One turn of the screw was given, and the alarm sounded again in ten minutes. The aneroid at the moment of the second alarm indicated 8 per cent of gas. These experiments were made with a new instrument covered with ⅛ inch marble, and an old instrument the thickness of marble I do not recollect." This was an old instrument which had been in use a year in some pits and is covered with ¼ inch marble.

On Tuesday August 27, I went into the pits with Mr. Murray and some of his people, experimenting till 11.30 p.m. without a single failure. Quite the last thing, we chased the pit of gas and set four syphon instruments with a view to see if when gas accumulated slowly in the night the instruments would give warning and maintain their action till the morning. These instruments were visited in the morning by Mr. Crum and the fireman of the pit. Mr. Crum writes to me as follows:— "The place in the pit was filled with fire-damp till past the battery and the bell. The bell rung with 1¼ inch of zinc above top. All observations in the dark—no light even in main road—no Davy lamp."

Mr. Murray was present at part of these experiments, and the fireman, accompanied by a collier, was present at the whole of them reading the barometer indicator with me. Mr. Murray says, "There is no doubt from these experiments, which extended over a fortnight, that the instruments are quite reliable and quite easily managed. We worked under great disadvantages, the place was very low, I think the men said three feet four inches; but there is no difficulty in obtaining the results needed."

Professor ANDERSON believed that this was the first attempt to apply the law of diffusion to practical purposes, and it was certainly an invention of the highest importance. The only drawback to the instrument was that its nicety required it to be worked, not by ordinary colliers, but by intelligent men.

Mr J. L. BELL, of Newcastle, feared that the very nature of the work of a colliery, which would necessitate the perpetual movement of the apparatus, might impede its use by the workmen; but thought that, in the hands of the coal viewers, it might be turned to good account, as the accidents most feared by coal owners were those in which the atmosphere of a whole gallery, or a portion of one, was polluted. The instrument would be likely to be of immense value in the prevention of that wholesale destruction of life we had so often to lament. He was afraid, however, that familiarity would breed contempt, and that after the novelty of the invention had passed away, the men would be apt to neglect it.

Mr. ANSELL, in reply, stated that Mr. Murray's ordinary working colliers had used the instrument with perfect success. Mr. Murray had suggested that the whole apparatus should be enclosed. When this was done the workmen could in no way misuse it.

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SECTION B. CHEMICAL SCIENCE.

"*Notes of Analyses of Gold Coins of Columbia, New Grenada, Chili, and Bolivia; with some Account of the Operations of Gold Mining in Nova Scotia, Dominion of Canada.*"

By GEORGE LAWSON, PhD., LL.D.,
Professor of Chemistry, Dalhousie College, Halifax, N.S.

THE first part of this paper was principally devoted to the history and description of the gold coinage of the abovementioned countries, with physical and chemical analyses. Some information was then given respecting the composition of the native gold of coining conntries, and a useful list was appended, showing the principal gold coins of various countries, with their weights, fineness, and values, and a synopsis of the results of assays and analyses of native gold from the chief mines of the world.

The author then proceeds in the following words:—"Writing from a gold country, it may not be out of place if I refer briefly to the results of gold mining in this province. The geological relations of our auriferous quartz veins, so far as ascertained, have been detailed by several able geologists. I shall, therefore, merely offer a few statistics, serving to show the extent and present condition of the mines, which, although they have not proved so profitable as was anticipated by speculators, are still vigorously worked in most of the districts."

The general results of the gold mining operations in Nova Scotia up to the end of last year (1866) are shown in a table, the facts in which may be thus summarised:—"Total amount of quartz, &c., crushed, 101,946 tons; gold obtained, 91,958 ounces, nearly three tons weight, worth £380,861; giving an average of 21½ grains of gold for every 100 lbs. weight of quartz crushed, and an average annual yield of gold of 20 oz. for every man employed, or a daily return of 6s. 10d. per man for every working day. This return has to meet, not only the wages of men, but likewise interest on capital, royalty, tools, machinery, and expenses of management.

"The gold of all the Nova Scotia mines compares very favourably with that obtained in other countries; in other words, our gold is remarkably pure. Whilst Californian gold, as shown by thousands of assays, contains on an average 11½ per cent of silver, and the gold of several of the South American States a much larger proportion, our Nova Scotia gold contains (on an average of analyses) less than 4 per cent, and some samples less than 2 per cent of silver. The gold would be still purer were it not that the various metallic minerals that occur in the quartz veins and adhering slate and quartzite are crushed up with the gold in the process of extraction; and, no doubt, likewise whilst iron and copper are abstracted from the stamping boxes and machinery during amalgamation, lead, silver, &c., are probably introduced from impurity of the mercury employed. The principal minerals of the auriferous quartz veins here are zinc blende, galena, iron and copper pyrites, and mispickel (arsenical pyrites); which last abounds in some mines, and causes inconvenience to the workmen, if the ore be roasted before crushing."

In all our mines the gold is separated by the method of amalgamation. The quartz is pulverised in a strong iron stamping box, which rests on a heavy granite block to resist the continual action of the heavy piston hammers. The stamping box contains mercury, and has a continuous supply of water. The powdered quartz is continually floating out, as a silt or "slime," through a wire gauze arrangement, and is carried in a small shallow sluice over little sunken cups or pools filled with mercury, then through a series of sluices or "shaking tables" lined with copper, the surface of which has been rubbed or amalgamated with mercury; these shaking tables are arranged one under the other like steps of a staircase, and have a continued oscillating motion, whilst the stream of water (hot or cold) runs from one to the other, carrying the slimes. Thus the process goes on continuously,—a "crusher," as it is called, being in reality a mill in which the various processes of pulverising, washing, and amalgamating go on during the week without interruption. A crusher usually consists of a number of stamping boxes, and relative sluices, and other arrangements, such as described, arranged parallel to each other, so that two or three men may conveniently feed the whole of the stamping boxes. The mercury takes up the gold from the sluices as they pass over its surface, and the amalgamated surfaces of copper slowly become incrusted with a dull pasty coating. This pasty substance of a leaden colour is the gold amalgam, a chemical compound of gold and mercury. Once a week the mill is stopped, or it may be once a fortnight, or once a month, and the pasty incrustation is carefully scraped away from the shaking tables and sluices, the mercury is taken out of the cups or grooves, and the whole put into an iron retort; heat is applied, the mercury is distilled off to be used again for the absorption of fresh supplies of the precious metal, and the gold is found at the bottom of the retort in the form of a more or less porous and impure mass. It is remelted to get rid of impurities, and is then ready to be sent in the form of a brick or bar to the bank or mint.

The process lately invented by Mr. Crookes, by which sodium amalgam is added to the mercury, has not yet been taken advantage of to any extent in our mines. I have experimented to a considerable extent on the effects of sodium amalgam, and find it to exert a very remarkable power in facilitating the absorption of gold by mercury, quite independently of any action of the soda necessarily formed during the operation. I believe, therefore, that much benefit would result from the use of Mr. Crookes's amalgam. The coating of the copper surfaces with mercury alone has been found practically to be a troublesome and tedious operation; but the use of a little sodium amalgam added to the mercury enables the coating to be given by a simple rubbing without any waste of time. Some illustrations of the advantages of Mr. Crookes's process were given in a paper which I published last year in the *Transactions* of our Institute of Natural Science.* It was stated that in some experiments undertaken in conjunction with Dr. Krackowizer, formerly of Vienna, at the Lake Major Mines, a quantity of pyrites collected from the tailings (after passing through the mill in the usual way) was re-subjected to the action of mercury, to which sodium had now been added, and by this means the waste material from which all the gold was supposed to have been abstracted, yielded a fresh supply at the rate of five ounces of gold per ton of pyrites. In the washing of alluvium, during which there is a great loss of mercury from "flouring," the advantages of Mr. Crookes's process were equally obvious.

Professor ANDERSON, in proposing thanks to the author of this paper, asked Mr. Crookes, who was in the room, if he could give any further details respecting the sodium process of amalgamation of which he was the inventor.

* "On some recent Improvements in the Amalgamation Process for Extracting Gold from Quartz." By George Lawson, LL.D. *Trans. Inst. Nat. Science of Nova Scotia*, part iv., pp. 71—76.

Mr. CROOKES said that there was one thing which ought especially to be attended to in employing this process, and that was to avoid introducing too much sodium. Every failure which had come under his notice had arisen from ignorance of the action which the sodium was intended to exert on the mercury. If too much were added it exerted a chemical action, reduced the iron, copper, lead, &c., which might be present in the ore, and loaded the mercury with base metals, destroying its power of wetting gold, and causing it rapidly to flour away when triturated in a stream of water. If, however, only a trace of sodium were introduced (say 1 in 10,000 or 1 in 100,000), it acted physically rather than chemically; it put the mercury into a highly electro-positive state, and by greatly widening the electric interval between this metal and gold, increased their mutual affinity.

Professor WILLIAMSON said that some specimens of auriferous pyrites had been brought under his notice, containing as much as 25 ounces of gold to the ton, and which yielded nothing whatever by the ordinary mercurial treatment. He was anxious to know from Mr. Crookes whether his sodium process would extract the gold, and would also enquire whether it was known in what state of combination the gold existed.

Mr. CROOKES replied that the general opinion was that the gold existed in auriferous pyrites in the metallic state, and not as a single or double sulphide. The gold was sometimes visible in plates between the crystals of pyrites, and was frequently left behind in the form of brilliant spangles and crystals on dissolving the pyrites in acid.

Although mercury in its ordinary state would not extract the gold from pyrites, the addition of a trace of sodium conferred this property upon it, and in skilful hands it was easy to obtain almost the assay quantity of gold without appreciable loss of mercury by flouring.

Monday, September 9th.

The meeting was very well attended this morning. The first paper was one entitled,

"*Remarks on the Calculus of Chemical Operations.*"

By Dr. A. CRUM BROWN.

This was followed by an exceedingly animated discussion, in which Professor Clerk Maxwell, F.R.S., Rev. Professor Harley, F.R.S., Mr. A. R. Catton, Professor Wanklyn, Dr. Odling, F.R.S., and Dr. Williamson, F.R.S., took part. The line of argument was somewhat similar to that adopted on the occasion of the discussion of Sir B. Brodie's paper at the Chemical Society, and the general feeling was adverse to the introduction of so radical a change as that advocated by Sir B. Brodie, although most of the speakers appeared disposed to reserve their opinion till the publication of the second part of the "Calculus of Chemical Operations." Time will not admit of our preparing an abstract of the paper and discussion in time for publication this week.

This was followed by a paper—

"*On certain New Processes in Photography.*"

By J. SPILLER, F.C.S.

I have the pleasure of submitting to the notice of the Section several interesting results and improvements in photography, based, it may be said, on the chemistry of gelatin. The processes to which I refer are the various modifications of the Woodbury type, including the new method of micro-photo-sculpture, the art of photo-lithography, as practised in the Royal Arsenal at Woolwich; and some illustrations of the use of gelatin or albumen, on a foundation of silk, satin, or cambric, the work of H. P. Pritchard, of the War Department.

The Hon. H. Fox Talbot was one of the first to describe and make a practical use of the action of light upon a mixture of gelatin and a soluble bichromate, and after him Colonel Sir Henry James, Mr. Swan, of Newcastle, and Mr. Woodbury, of Manchester, have applied the same chemical principle in new directions. It is known that the chemical rays of light have the effect of rendering insoluble gelatin to which a bichromate has been added. It would appear that this oxidising salt hardens the animal substance, by forming with it a combination of chromic oxide. In proof of this view, it may be stated that Mr. Swan has lately devised a mode of working, in which a minute quantity of chrome alum or sulphate of chromium is used instead of the red chromate, and it is found that when dried this mixture is not again affected by water. The carbon prints of Mr. Swan, which were exhibited and so much admired last year at Nottingham, are illustrations of the use of a chromate in conjunction with gelatin and pigments. Mr. Woodbury's process is also based on the insolubility of the chromo-gelatin after exposure to light, and upon the subsequent action of water upon a sensitive film, which has been in different degrees influenced by insolation under an ordinary photographic negative. The depths of tint in the original are represented by variations in the thickness of the film of gelatin left unacted upon by water, and this dried may then be used as a matrix to produce a corresponding series of depressions upon a surface of lead or type metal by the aid of a powerful hydraulic press. The blocks so produced serve for printing off a great number of proofs when they are liberally "inked" with warm gelatin, highly charged with Frankfort black or other suitable pigment, and pressed down upon a smooth sheet of paper until the excess of ink is forced out on all four sides of the block, and so removed from the space constituting the picture, which, when set, is, lastly, protected with a varnish of collodion. (Specimens of the Woodbury type were exhibited.) A glass plate may be used instead of paper to receive the ink, and this, backed with another (opal) glass, gives an excellent result, suitable for a variety of ornamental purposes. (Specimen shown.)

Mr. Woodbury has lately perfected a modification of his process, which is applicable to the representation in high relief of microscopic objects. The method consists in spreading a warm solution of gelatin, containing a little sugar and chromate of potash, over a glass plate previously coated with collodion. The film sets on cooling, and is then placed in contact with an ordinary photographic negative of the microscopic objects to be delineated, exposed to light, submitted as before to the action of water, and the soluble portions washed away. When the surface moisture has evaporated, a mixture of plaster of Paris, containing a small proportion of alum, is poured over the relief to the thickness of half-an-inch, and left to set. When dry it will be found, owing to the alum in the plaster hardening the surface of the gelatin, directly on coming in contact therewith, to leave the gelatin easily, without any fear of adhesion. To give a finished appearance to the resulting casts, this intaglio, when dry, may be placed in a lathe, and a suitable border turned on it, which will be represented in the resulting proofs by a raised border, similar to what is seen on medallions or plaster casts. The name of the object may also be neatly engraved on the intaglio, to appear in raised characters on the reliefs. This intaglio should then be well waxed to fill up the pores, and is ready for taking any number of impressions in plaster; or a better plan is to take one in plaster, and having smoothed away any defects to mould a reverse in sulphur. which will give a greater number of fine impressions. (Specimens exhibited).

Great progress has been made during the last year in perfecting the details of photo-lithography, and the results which I now exhibit are illustrations of the practical use of this art as a means of procuring on a reduced scale printed reproductions of the large series of lithographs used for the use of the British army by the Royal Carriage Department. Negatives of the required size are taken in the first instance by the collodion

process, this service being performed in the photographic establishment of the War Department at Woolwich, under my supervision. The pictures are then copied upon a sensitive surface, prepared by floating a sheet of bank post paper upon warm chromo-gelatin solution, made as follows:—I. Gelatin, 3 oz.; hot water, 40 oz. II. Bichromate of potash, 2 oz.; hot water, 10 oz. The two solutions are mixed together, and should then be kept from the light. The prepared side of the paper is taken dry, laid against the negative, and for a short time is exposed to light. It is then greased all over by spreading a thin layer of "litho-transfer ink" upon stone, and passing through a lithographic press, and the whole surface is in the next place submitted to the action of warm water thickened with gum. The ink resting upon the unexposed portions of the print is thus removed, the gelatin in these parts remaining perfectly soluble, and the paper is washed with dilute gum water, using a sponge to assist in detaching the loosened layer of ink, and finally washed with warm water alone. This sheet of paper is an accurate transcript in lithographic ink of the original photograph. All the lines should be clear and sharp, and there will be no difficulty in transferring to stone and printing off any required number of impressions by following the details of the ordinary lithographic process. The cost of production is very trifling, and a large number of prints, both plain and coloured, have been executed in this manner by Mr. Henry Butter, of the Royal Carriage Department. I have, lastly, to show a few specimens of photographs printed on silk, satin, and cambric, the work of Mr. H. B. Pritchard, of the W. D. He produces them by salting the fabrics with the following solution:—Common salt 5 grammes; water, 500 cubic centimeters; albumen, the whites of four eggs. The air-dried fabric is then sensitised, printed, and fixed, in the ordinary manner, but with as little delay as possible. This method furnishes a means of reproducing photographs upon a stronger and more flexible basis than paper, and is particularly applicable for diagram purposes and architectural plans; we have used it in the Royal Arsenal for preparing sketches, and illustrated descriptions for military instruction and use in the field.

A discussion followed.

The next paper was one

"*On a New Polarising Photometer.*"

By W. Crookes, F.R.S.,

which will appear in our next.

MEETING OF THE GENERAL COMMITTEE.

A meeting of the General Committee was held on Monday afternoon for the purpose of determining the place of meeting of the British Association next year. His Grace the Duke of Buccleuch presided, supported by Sir Roderick Murchison, Dr. William Fairbairn, Professor Phillips, Sir John Lubbock, Prof. Tyndall, S. M. E. Grant Duff, Esq., Sir John Bowring, and the Earl of Enniskillen.

Deputations were present from Plymouth, Exeter, Norwich, Liverpool, and Edinburgh, inviting the British Association to meet in their respective towns next year. After a discussion the claims of Norwich carried the day, and it was decided that the British Association should meet in that city, in August 1868, under the presidency of Dr. Joseph Dalton Hooker, M.D., D.C.L., F.R.S., &c.

The following gentlemen were appointed Vice-Presidents for the next year's meeting of the Association:—The Earl of Leicester, Lord-Lieutenant of Norfolk; Sir John Peter Boileau, Bart.; Sir John Lubbock, Bart., F.R.S., the Rev. Adam Sedgwick, M.A., F.R.S., &c., Woodwardian Professor of Geology in the University of Cambridge; J. Couch Adams, Esq., M.A., D.C.L., F.R.S., Lowerdean, and Professor of Astronomy and Geometry in the University of Cambridge; Thomas Brightwell, Esq.

Dr. Dalrymple, Rev. Canon Hind Howell, and Rev. J. Crompton were appointed Local Secretaries; and S. Gurney Buxton, Esq., and Roger Kerrison, Esq., were appointed Local Treasurers for the meeting at Norwich.

In the evening Professor Alexander Herschel, F.R.A.S., of Glasgow, delivered a lecture on Meteors and Meteorites, in the Kinnaird Hall, which was crowded by a very brilliant audience.

A report of this lecture is unavoidably postponed for want of space.

On Tuesday the Chemical Section met as usual, when the following papers were read:—

I. Lothian Bell.—*On the Present State of the Manufacture of Iron in Britain, and its position as Compared with that of some other countries.*

J. B. Lawes and J. H. Gilbert.—*Preliminary notice of Results on the Composition of Wheat, grown for twenty years in succession on the same land.*

R. F. Smith.—*On the Gaseous Products of the Destructive Distillation of Hydrocarbons, obtained from Shales and Coals at low and high temperatures.*

P. Spence.—*On the Economisation of the Sulphurous Acid in copper smelting.*

W. L. Scott,—*On the Bisulphide of Calcium as a preservative of animal substances.*

W. L. Scott.—*Note on the Artificial Production of Oil of Cinnamon.*

T. T. P. Bruce Warren.—*On the Electrical Resistances of the Fixed and Volatile Oils.*

Full reports of these papers are in hand, and will appear next week.

CONCLUDING MEETINGS.

A meeting of the General Committee was held on Wednesday, Sept. 11. The Secretary read the grants of money for scientific purposes, from which we extract the following:—Dr. Anderson, Synthesis of Organic Acids, £60; Mr. E. R. Lankester, Investigation of Animal Substances with the Spectroscope, £15; Dr. Bennett, Action of Mercury on the Secretion of Bile, £25; Dr. Richardson, Physiological Action of the Methyl Series, £25. The Secretary then read the recommendations not involving money grants, which included resolutions relating to the continuation of storm signals; and the introduction of the metric system to government schools. These were referred to the Council of the Association. It was also recommended, in Section A.— That the Metrical Committee be re-appointed; that Professor Stokes be requested to continue his researches in physical optics; that Mr. Low, Mr. Glaisher, Dr. Moffat, Mr. C. Brooke, Dr. Anderson, and Dr. Ward Richardson be a Committee for the purpose of promoting accurate meteorological observations on ozone; that Dr. Tyndall, Dr. Lyon Playfair, Dr. Odling, Rev. C. Pritchard, Professor Kelland, Professor W. A. Miller, and Professor Foster, be a Committee for the purpose of enquiring into the present system of teaching the elements of dynamics, experimental physics, and chemistry in schools of various classes, and of suggesting the best means of promoting this object, in accordance with the recommendations of the report of the Committee appointed by the Council of the British Association, and that Professor Foster and Dr. Odling be the Secretaries. Section B.—That Dr. Matthiessen be requested to continue his researches on the chemical constitution of cast iron; that Mr. Fairley be requested to continue his researches on the polycyanides of the organic radicals; that the Committee on Scientific Evidence in Courts of Law, consisting of the Rev. William Vernon Harcourt, Professor A. W. Williamson, the Right Hon. J. Napier, Mr. W. Tite, Professor Christison, Mr. Carpmael, Dr. Tyndall, Mr. J. Heywood, Mr. J. F. Bateman, Mr. G. Webster, Sir B. Brodie, and Professor W. Allen

Miller (with power to add to their number) be re-appointed, and that Professor Williamson be the Secretary. The Secretary then read a recommendation:—That the President of the Association be requested to communicate the report of the Committee appointed by the Council to consider the best means for promoting scientific education in schools, to the President of the Privy Council, and to the Parliamentary Committee, on the part of the Association; and that the general officers be authorized to take steps to give publicity to the report. Dr. Richardson intimated that at the next meeting of the General Committee he would move that a Section for Applied Science should be formed. The concluding general meeting of the Association took place in the afternoon, at three o'clock. Mr. Griffiths made the following statement of the number of tickets which had been issued on the occasion of the Association meeting in Dundee:—167 old life, 25 new life members, 193 old annual, 118 new annual, 1,163 associates; 771 ladies, and 7 foreigners; total, 2,444.

MISCELLANEOUS.

Rapid Reporting.—We would draw attention to the promptness, hitherto unknown in the scientific press, with which the proceedings of the British Association were reported last week in these columns. It should be remembered that Dundee is fifteen hours' railway journey from London; but the CHEMICAL NEWS, which was in the hands of the public on Friday morning last, contained a full account of the proceedings in Section B of the previous day. Not only was Dr. Anderson's introductory address given in full, but the two most important papers were also reported, and the discussion given. All the important papers have been reported for us verbatim, and the discussions and papers of minor importance are reported in abstract; but our available space, although extended by the issue of a supplement, is still insufficient, and we are reluctantly compelled to defer the concluding part of the proceedings till next week.

Origin of Gypsum and Dolomite.—In a memoir read before the *Académie des Sciences*, 22nd April, this year —"Sur la formation des gypses et des dolomies" (*Compt. Rend.*, tome lxiv., p. 815), Dr. Sterry Hunt gives the results of an interesting experimental investigation on the origin of these rocks. After alluding to a previous communication to the Academy (23rd May, 1859), in which he demonstrated that the mutual reactions of bicarbonate of lime and sulphate of magnesia would give rise to the formation of gypsum and hydrated carbonate of magnesia, he proceeds to account for the origin of the carbonate of magnesia, which, under the form of dolomite, is found so abundantly in nature, unaccompanied by gypsum. He regards in the first place the carbonates of soda, lime, and magnesia to have been formed from the decomposition of primitive silicates by atmospheric carbonic acid, and that the carbonate of soda so formed precipitated first the lime and then the magnesia (more or less mixed with lime) from the primeval ocean; in cases of isolated basins of water previously deprived of its lime, carbonate of magnesia would be alone precipitated. The most important point in this investigation, however, is the discovery announced by Dr. Sterry Hunt of the mode in which the chemical reactions concerned in the production of dolomite and gypsum are modified under the influence of an atmosphere of carbonic acid, from which he infers that the ancient period was much more favourable to the development of these rocks, since the atmosphere of the primitive epoch must doubtless have contained much more carbonic acid than at present; and concludes by ascribing to this cause the production of the great masses of gypsum associated with dolomites which are found in the most ancient formations up to those of the tertiary period.

M.P. for London University.—Candidature of Sir John Lubbock.—An influential meeting was held, in the Committee Room of Section D., of gentlemen anxious to assist the Committee of Graduates formed to secure the election of Sir John Lubbock as representative of the University of London. Among those present were—Sir W. Thomson, President of Mathematical and Physical Section; Dr. Sharpey, President of the Section of Anatomy and Physiology; Prof. Busk, President of the Section of Zoology and Botany; Prof. Wheatstone; Prof. Sylvester; Prof. Tyndall; Prof. Allen Thomson; Prof. Ansted; Dr. Williamson; Mr. Gassiott; Prof. Hirst; Dr. Odling; Dr. Turner; Prof. M. Foster; Prof. G. C. Foster; Dr. A. C. Brown; &c. Professor Tyndall was in the chair; and it was proposed by Sir William Thomson, and seconded by Professor Williamson, and carried unanimously:—"That Sir John Lubbock, Bart., having been brought forward by an influential party among the graduates of the University of London, and an opportunity being thereby afforded of obtaining for science a representative in the House of Commons, it is highly desirable that those who are interested in science should do all in their power to secure his election."

NOTES AND QUERIES.

The Word Aneroid.—Aneroid is derived from the Greek ἀ privative—*without*, νηρος—wet, damp, or fluid, *i.e.*, barometer without mercury, or fluid.—A.

Phthalic Acid.—Sir,—Can any of your readers give me the details of the manufacture of phthalic acid?—NAPHTHALINE.

Preservation of Crystals.—Sir,—In reply to "Cassio's" query last week, I beg to suggest that benzol is an excellent medium in which to preserve fine crystals. Most aqueous salts are insoluble in benzol. They can be removed for examination, and after a few minutes' exposure to the air the smell of benzol will have disappeared. If immersion in a liquid is objected to they may be oiled. Many crystals which change and become dull by exposure to air, as alum, sulphate of copper, sulphate of iron, ferro-cyanide of potassium, &c., if slightly oiled, do not then alter in a long time, and many efflorescent substances are prevented from changing by the same means. Even crystals of sulphate of soda may be exposed to the air for weeks together without efflorescing if well oiled. The plan is to soak the crystals in fine olive oil for a few hours, then to wipe them on soft cambric and put them in bottles.—A. THOMPSON.

Platinising Metals.—Sir,—I can recommend my fellow-reader who applies for information on this subject to adopt the following process, given by Professor Church, in the *Intellectual Observer*, some time back:—"Dissolve in one ounce of distilled water sixty grains of bichloride of platinum and sixty grains of pure honey. Add to the above solution three-quarters of an ounce of spirits of wine, and one-quarter of an ounce of ether. The mixed liquids, if not quite clear, must be filtered through a piece of white blotting-paper. The objects to be platinised, which may be of iron, steel, copper, bronze, or brass, are to be thoroughly cleansed by washing them in soda, then in water. When they have been dried, they require heating over a lamp, to a heat below redness. For this purpose they may be suspended, by means of a fine wire, over a spirit or an oil lamp, in such a way as not to touch the flame. Suddenly, before they have had time to cool, the objects are to be completely plunged beneath the surface of the platinising liquid. One immersion for a single minute generally suffices; but the process may be repeated if necessary, care being taken to wash and dry the pieces operated upon before re-heating them. The composition of the solution may vary considerably, and yet good results be obtained. Sometimes the addition of more honey improves it; sometimes the proportion of bichloride of platinum may be increased or diminished with advantage. Indeed, it will be found that the appearance of the platinum film deposited upon the objects may be altered by changing the proportion of the bichloride present. The solution may be used several times; gradually, however, it loses all its platinum, the place of this element being taken by the iron or copper dissolved off the immersed objects." I have tried the plan and found it very successful. I am very happy to contribute my mite towards a column which has frequently given me more information than any other in your valuable journal.—W. BEAZLEY.

TO CORRESPONDENTS.

To Correspondents.—In consequence of the lengthy report of the British Association meeting we are compelled to postpone our Answers to Correspondents till next week.

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THE CHEMICAL NEWS.

Vol. XVI., No. 407.

AN IMPORTANT ADJUNCT TO THE INDUCTION COIL.

By HENRY MORTON, Ph.D.

The arrangements I am about to describe have proved of great value to me, and will, I presume, be of like use to others who may have need of similar lecture illustrations.

Take eight plates of glass, about 11 inches by 14 inches, and attach to both sides of each plate sheets of tinfoil 7 inches by 10 inches in size, with rounded corners. Set these plates upright in a box (provided with grooves for the purpose) about 1½ inches apart; then, rolling up some balls of paper large enough to fit between the plates, and wrapping a strip of tinfoil around each ball, thrust them between the plates, and, lastly, make an outside pole to the terminal sheets of foil by means of wires enclosed in glass tubes passed through the side or top of the box. It is evident that we have here a compact form of Leyden battery arranged for "cascade." With the ordinary electrical machine such an arrangement would be worthless from its want of insulation. With the induction coil, however, which developes an entire charge in an instant, it becomes of great value in a certain class of experiments, because it gives us at once the concentrated charge peculiar to the Leyden battery, combined with a spark length which it otherwise lost. (This property of long spark in the "cascade" arrangement of jars is well known.)

If such an apparatus as we have just described be connected with the secondary poles of an induction coil, and other wires are then led off (with a break in the circuit, however, of ¼ to ¾ inches) to some piece of apparatus for the illustration of electric discharge in vacuo, such as Gassiot's cascade (especially with a canary goblet), the Aurora tube, an electric egg of canary glass, &c. (but not a Geissler tube), the brightness of the illumination and volume of the discharge will be immensely increased. Thus a goblet invisible at 30 feet when the unaided coil is used, becomes *brilliant* at 50 feet with this attachment. I have used two coils with the above apparatus, both made by Mr. E. S. Ritchie, of Boston, one (which is my own property) yielding a spark of 8 inches, the other (also in my hands, as it belongs to the Physical Cabinet of the University of Pennsylvania), which gives, in its present mounting, sparks of 16 inches, but is capable of yielding sparks two feet in length. Such sparks were, in fact, obtained from it by Mr. Ritchie during its manufacture; but, in mounting it, the poles have been secured at a maximum distance of 16 inches to provide against accident, such a length being abundantly sufficient for use. How the above battery would work with smaller coils I cannot say. Geissler tubes, unless of very large area, are not benefited in appearance by this arrangement; because, as I believe, the coil unaided can supply all the electricity they are capable of transmitting, and this excessive charge only tends to develope inductive resistances in the glass tubes themselves, which resistances this *momentary* current is the least fitted to overcome.

Allow me to mention another little practical detail in this connection. It is generally assumed that the induction coil is unfit for the exhibition of those experiments of attraction and repulsion which especially characterise statical electricity. A great number, however, may be very satisfactorily exhibited by charging Leyden jars and using them as the sources of electricity. Thus, connect a chime of bells with the knob of a large jar, connect the outer coating with the earth and with the negative pole of the coil; then bring the positive pole within striking distance of the knob, and charge by a few sparks. The electrical flyer, orrery, sportsman and birds may be successfully operated in this way, even in summer weather.

Probably, however, the coil should not be of less than 6 inches spark length.

University of Penna, Philadelphia.

ON THE SO-CALLED "INACTIVE" CONDITION OF SOLIDS.

By CHARLES TOMLINSON, F.R.S.

In the Chemical News for the 2nd of August is given a notice of my paper on the above subject, in which I endeavour to prove that the action of solids in disengaging gases from their solutions, or in inducing crystallization in saline solutions, is simply a question of adhesion depending on the state of purity of the surface of the solid. I have since endeavoured to express my theory in such general terms as to embrace a larger number of phenomena, which indeed seem to increase the more it is examined.

My theory, as it now stands, is as follows:—

Any supersaturated solution of gas, with its upper surface freely exposed to the air, is always giving off that gas, either with effervescence, or silently and imperceptibly. It does so because the excess of gas has only a slight adhesion for the liquid, and the air is virtually a vacuum for it, the only difference being, that it would pass off into a real vacuum suddenly and instantaneously. The remaining surface of the liquid, or that confined by the sides of the vessel, is in exactly the same state, subject however to two conditions—(1) the purity of their surface, and (2) the pressure exerted by them (virtually) on the liquid.

(1.) Suppose the vessel to be chemically clean. No gas will be disengaged, and no bubbles will form on the sides, because the adhesion between the sides and the liquid is perfect. Hence the sides may be considered, *pro ratâ*, as merely a continuation of the liquid itself, and no bubbles will form there any more than in the central parts of the liquid. But suppose the sides to be dirty, adhesion is diminished *or* annulled; and therefore the surface of the liquid next to such sides is virtually as free as its upper surface. (2.) Hence bubbles will form here, just as they form on the upper surface; but in the latter case they do not appear as bubbles (except in effervescence) because there is no pressure. The sides do exert pressure, and therefore bubbles are formed. Now it does not at all matter whether there be air or not between the sides and the liquid: there may probably be a vacuum or any other gas. The result will be the same. Hence it is futile to talk of the air as disengaging bubbles, as in M. Gernez's theory; it is really want of adhesion. Now to apply this to the case of the so-called "inactive" glass rod. A rod, a coin, a piece of flint, &c., placed in the liquid, does nothing more than form new sides, as it were, to the vessel, and its effect is merely that of the sides. If chemically clean, the rod, &c., will form no bubbles round it, and it is called "inactive" because its adhesion is perfect. If dirty, the surface of liquid in contact with it, will be as free, or almost so, as the upper surface.

The same theory applies equally well to the action of *nuclei* in inducing crystallisation. It also applies to the common theory of ebullition, and the action of the vessel in raising or lowering the boiling-point under the same pressure. Writers down to our own day state that water boils at about 105° C. in a glass vessel, and at 100° in a

metal vessel; at a lower temperature in vessels whose internal surfaces are rough than in smooth ones; that *bumping* is produced when the liquid has comparatively little adhesion to air; and soon I think it can be proved that these and other phenomena which figure in our text-books as remarkable facts, can be explained with reference to the same law of adhesion, and have nothing to do with the air except indirectly.

King's College, London, Aug. 31, 1867.

REVISION OF THE MINERAL PHOSPHATES.

By A. H. CHURCH, M.A.,
Professor of Chemistry, R. A. College, Cirencester.

Continued from vol. XII. p. 183.

No. VI. OSTEOLITE.

A STATEMENT appears in some chemical works to the effect that osteolite, a white and compact mineral not unlike fine lithographic stone, is really pure tricalcic diphosphate $Ca''_3 2PO_4$. All the analyses, however, of this substance which have been published, point to a very different conclusion; and, in fact, a pure native tricalcic diphosphate is still unknown. My analyses of specimens of osteolite from various localities serve to confirm the notion that this so-called species is merely an apatite more or less altered by the substitution of calcic carbonate for the chloride or fluoride.

One of my specimens was from Eichen, Wetterhau. It was white, hard, and tough, showed slight signs of being stratified, and had a density of about 2·86. The following are the analytical results:—

35·46	grains	osteolite	gave	..	..	·83 grain	H_2O
,,	,,	,,	,,	..	.. 30·97	,,	$Ca''_3 2PO_4$
,,	,,	,,	,,	..	.. 4·26	,,	$Ca''CO_3$
55·32	,,	,,	,,	..	.. 1·39	,,	CO_2

From these results we find that more lime was present in the mineral than sufficed to saturate the phosphoric and carbonic acids. Qualitative tests revealed the presence of much fluorine. If the remainder of the calcium be calculated as if in union with fluorine, the following satisfactory percentages are shown:—

$Ca''_3 2PO_4$	87·25
$CaCO_3$	5·70
CaF_2	4·92
H_2O	2·34
	100·21

Osteolite, therefore, cannot rank as a distinct species: it is a more or less altered apatite.

ON THE REFRACTION EQUIVALENTS OF SALTS IN SOLUTION.*

By J. H. GLADSTONE, F.R.S.

THE British Association has already more than once heard of "refraction-equivalents," but for many chemists the term may still require definition. It is well known that every body has the power of bending a ray of transmitted light, and that this power may be expressed by a number, termed the "refractive index." Now this "refractive index," *minus* unity, divided by the density of the body, is termed its "specific refractive energy,"—a property of great importance, and one that accompanies the body, notwithstanding great physical or chemical changes; for instance, to quote words formerly used, "as a rule, when a gas, liquid, or solid dissolves in water, it preserves its specific refractive energy." * For many purposes it is convenient to multiply this number by the atomic weight of the substance, and that is termed its "refraction-equivalent."

Now it is not difficult to arrive at the refraction equivalent of a salt in solution. Let a weight of it, answering to its chemical equivalent, be dissolved in a certain number of equivalents of water; the refraction-equivalent of the whole solution will consist of the refraction-equivalent of the salt, *plus* so many times the refraction-equivalent of water; and as this number is known, we have only to subtract it from the whole to obtain the refraction equivalent desired.

It occurred to me that if a series of salts in solution were thus examined, I might arrive at numbers from which many interesting facts might be deduced, and especially that it might afford data for determining the refraction-equivalents of all the metals, and of those substances with which these metals will combine to form soluble salts.

As the determinations are matters of great delicacy, especially when the solutions are weak, I am having a superior apparatus made by Mr. Browning for the purpose; but some preliminary observations have been made with the old apparatus of Baden Powell, and these perfectly confirm my expectations, and induce me to undertake a careful examination of the whole subject.

In the first place I prepared solutions of iodides, bromides, and chlorides. The metallic iodides gave refraction-equivalents ranging from 30·5 to 35·3; the metallic bromides from 21·7 to 25·3; and the metallic chlorides from 15·1 to 18·6, the highest number in each instance being the potassium salt, while the ammonium compounds of these halogens gave numbers more than three higher. Again, it was at once evident that the dispersion-equivalent of an iodide was at least double that of a bromide, and three times that of a chloride. On comparing the salts of the same metal this difference between the halogens was still better defined, the number for the iodide almost invariably exceeding that for the bromide by a little more than ten, and that for the chloride by a little more than sixteen. It was evident, therefore, that the halogen was exerting the same influence on the rays of light with whatever metal it was combined; and that any metal, as calcium, was unchanged in its refraction-equivalent, whether it was united to chlorine, bromine, or iodine. This observation was subsequently extended to a totally different class of salt, the sulphates, which give numbers always about one less than those given by the chlorides.

It may be asked—What numbers do you deduce from these results as to the refraction-equivalents of the metals? Unfortunately I am not in a position to reply with certainty. If we knew the refraction-equivalents of chlorine, bromine, or iodine, it would be easy; but the numbers previously deduced for them from organic compounds evidently require some rectification before they can be applied to this purpose. I hoped to arrive at the matter from the refraction-equivalents of the hydracids in solution, as the number for hydrogen is known to be 1·3; but I obtained such high numbers for hydriodic, hydrobromic, and hydrochloric acids, that I am disposed to think hydrogen in these compounds must exert a far greater refractive influence on the rays of light than when alone, or combined with carbon or oxygen.

In any case the refraction-equivalents of the metals examined in solution are very low as compared with the known refraction-equivalents of non-metallic bodies, except those that have very small atomic weights. They present themselves in about the following order, commencing with the lowest:—Magnesium; lithium; sodium; zinc; calcium; manganese; cadmium; copper; strontium; iron (ferricum); barium; potassium; ammonium.

† Read before the British Association, in Section B.

* *Journ. Chemical Society*, May, 1865.

ON THE COMMERCIAL ANALYSIS OF SOME OF THE PRODUCTS AND MATERIALS OF THE ALKALI MANUFACTURE, &c.

By C. R. A. WRIGHT, B.Sc., F.C.S.

(I.) Salt-cake.—Ordinary salt-cake is valued according the percentage of "Available sulphate of soda" contained; *i.e.*, the percentage of Na_2SO_4 existing mainly as such, and partly as $NaHSO_4$. The mode of estimation of the available sulphate usually pursued is the following:—

1. The NaCl is determined volumetrically by a standard silver solution.

2. The quantity of a standard alkaline solution required to render a known weight of salt-cake exactly neutral to test papers is determined, and the result, sometimes calculated as SO_3 sometimes, as SO_4H_2, called "free acid."

3. The difference between the sum of the two previous determinations and 100 is assumed to be "available sulphate of soda."

By this mode of proceeding errors of one to three or more per cent are introduced; ordinary salt-cake containing, in addition to Na_2SO_4, $NaHSO_4$, and NaCl, perceptible quantities of $PbSO_4$, $Fe_2(SO_4)_3$, Fe_2O_3, $CaSO_4$, $MgSO_4$, moisture, and particles of sand, brick, &c., derived from the furnace during the manufacturing processes. Where a greater degree of accuracy is desirable, a known weight of salt-cake may be treated with water, ammonia and ammonium oxalate added to the unfiltered solution, and the precipitated Fe_2O_3 and $CaCO_3$, with the insoluble matters, weighed after ignition: by moistening the ignited precipitate with pure SO_4H_2, and igniting again, the $CaCO_3$ is converted into $CaSO_4$, and then the weight of the mixed substances indicates all the "impurities" present in the salt-cake, with the exception of the $MgSO_4$, which rarely amounts to more than traces, and the moisture, which is occasionally a very perceptible quantity, especially in samples that have been made some length of time.

The amount of ferric sulphate present depends on the degree of heat to which the salt-cake has been subjected during manufacture. In highly roasted samples, cold water yields a solution containing no iron whatever, all the iron present in the salt-cake consequently existing as Fe_2O_3; specimens of under-roasted salt-cake, on the other hand, when treated with cold water, leave only fragments of brick, $CaSO_4$, &c., undissolved, all the iron existing as $Fe_2(SO_4)_3$. In ordinary salt-cake, however, there is so little ferric sulphate, that no perceptible error is committed in assuming that all iron present exists as Fe_2O_3, and all the "free acid" as $NaHSO_4$. Accordingly the following methods have been found to give tolerably expeditiously the exact composition of such salt-cake.

(*a*.) A known weight, 5 or 10 grammes, is dried at 110° —120° C., till constant in weight; too great elevation of temperature being avoided to prevent any possible loss of HCl by reaction of the $NaHSO_4$ on the NaCl present.

(*b*.) The NaCl is determined volumetrically by a standard silver solution.

(*c*.) A solution of sodium hydrate free from carbonate, or of caustic ammonia, of known strength, is added to a known weight of salt-cake until test-papers indicate exact neutrality of the liquid; the alkaline solution used accordingly corresponds to the $Fe_2(SO_4)_3$ and $NaHSO_4$ together, and may therefore be safely calculated as the latter.

(*d*.) A known weight of salt-cake is boiled with an excess of a standard sodium carbonate solution, and filtered; the unneutralised alkali is then determined by a standard acid solution. The amount of alkaline solution neutralised by the salt-cake indicates the $CaSO_4$,$NaHSO_4$, and $Fe_2(SO_4)_3$ together; and hence the difference between (*c*) and (*d*) indicates the $CaSO_4$. Or the $CaSO_4$ may be determined gravimetrically by precipitation with ammonium oxalate after separation of the Fe_2O_3 by ammonia from the solution of a known weight of salt-cake in hydrochloric acid.

(*e*.) The precipitate thrown down in (*c*) may be collected and boiled with hydrochloric acid; the insoluble bricks, &c., may be weighed, and the ferric salt reduced by zinc or other reducing agent, and titrated volumetrically by permanganate or otherwise.

(*f*.) When the $PbSO_4$ is to be determined, it may be done by treating a considerable quantity, say twenty grammes, with water, and boiling the insoluble residue with strong hydrochloric acid, till the $PbSO_4$ is entirely dissolved, and from the solution PbS may be thrown down by sulphuretted hydrogen, and the lead determined in the ordinary way.

(*g*.) If $MgSO_4$ is to be determined, it may be done by dissolving a known weight, say twenty grammes, in hydrochloric acid, adding ammonia and ammonium oxalate, and precipitating the magnesia from the filtrate by a phosphate, and ultimately weighing the magnesium pyrophosphate.

(*h*.) If the preceding determinations have been carefully conducted, the difference between 100 and the sum of them may be safely taken as Na_2SO_4; if this is to be directly determined, however, it may be done either by determining the total SO_4 present by dissolving a known weight of salt-cake in hydrochloric acid, and precipitating by $BaCl_2$, and weighing the $BaSO_4$; subtracting the SO_4 contained as $CaSO_4$,$NaHSO_4$,$MgSO_4$,$PbSO_4$, the remainder being calculated as Na_2SO_4; or by adding ammonia and ammonium oxalate to the aqueous solution of a known weight, and estimation of the residue left on evaporation of the filtrate and ignition with SO_4H_2: on subtraction from this of the amounts due to $MgSO_4$, NaCl, and $NaHSO_4$, the Na_2SO_4 is directly ascertained.

The writer has obtained very concordant results by either of these plans, viz., estimation of Na_2SO_4 by difference, by determination of total SO_4 present, or by determination of total Na present. The total "available sulphate of soda" is known by adding $\frac{71}{120}$ of the $NaHSO_4$ to the amount of Na_2SO_4 found.

II.—Black-ash is rarely sold as such, being generally converted into soda-ash on the spot where it is made. Commercially, the only valuable ingredient is the sodium carbonate, the amount of which is generally determined by lixiviation of a known weight of black-ash, and titration by normal test acid of the liquor obtained. In manufacturing establishments it is frequently the practice to lixiviate the ash with water at some definite temperature, considered to be about the average temperature of the lixiviating vats; the liquor so obtained is examined (*a*) for alkali, determined by test acid; (*b*) for sodium sulphate, generally estimated roughly, but with sufficient nearness for manufacturing purposes, by addition of a standard barium chloride solution to a portion of the acidulated lixiviate, till no further precipitate is thrown down; (*c*) for sulphide, estimated by passing chlorine through the alkaline lixiviate till all sulphide is destroyed; boiling with hydrochloric acid, and volumetric determination of the sulphate as before, the increased amount representing the sulphide. Prizes are frequently given to those workmen who produce black-ash containing but little sulphate, showing a nearly complete decomposition of the salt-cake employed; and occasionally prizes are given when the sulphate after oxidation is low in amount, it being supposed that this indicates that over-roasting of the black-ash has not occurred. A slight misapprehension, however, usually attends this mode of analysis; although an over-roasted black-ash will yield a perceptible quantity of sulphide when treated with nearly absolute alcohol, yet the fact of an aqueous solution containing sulphide by no means proves that the ash was over-roasted, inasmuch as

on addition of water to black-ash there is always a mutual reaction between the CaS, and Na_2CO_3 contained therein; the amount of Na_2S formed therein, as the researches of M. Kolb have shown,* depends on the temperature and dilution of the liquid, and the time employed; and accordingly it is often found that the sulphide existing in the black-ash lye from the vats is very different in amount from that calculated from the laboratory analyses of the black-ash worked. The laboratory test for "sulphate after oxidation," therefore, is really useless, as it neither denotes the quality of work done by the furnace-man nor that of the black-ash lye.

The writer has shown in a recent paper (*Chem. Soc. Journ.*, xx., 407) that there is contained in ordinary black-ash a sodium compound insoluble in hot water even on long digestion, but decomposable by long continued boiling. In cases, therefore, where the total "available alkali is to be exactly determined, either this long boiling must be performed, or the total sodium present must be determined gravimetrically, and that contained as chloride and sulphate subtracted; in either case a tedious operation. The same applies in the case of the analysis of the lixiviated black-ash, or vat-waste. Ordinarily the vat-waste is examined by lixiviating or washing on a filter a known weight of waste fresh from the vats, or previously completely dried. In either case a considerable amount of calcium hydric sulphide comes into solution, and hence if the solution so obtained be immediately titrated with test-acid, more soda is indicated as present than really has been dissolved out. By passing CO_2 through the solution till H_2S is completely expelled, boiling to decompose calcium bicarbonate, and filtration from the precipitated calcium carbonate, this error is avoided. The same effect is produced by adding ammonium carbonate to the solution and boiling in a flask till no further evolution of ammoniacal gases takes place; but in either case the sodium contained in the insoluble compound, or as sulphate (found by oxidation of calcium sulphide and subsequent reaction on the sodium carbonate, especially if the waste have been previously dried), remains unestimated. When accuracy is required, therefore, a gravimetric determination of sodium is unavoidable.

In cases where an accurate analysis of the total contents of a sample of black-ash is required, the following method gives reliable results tolerably speedily. Most of the modes of determination are likewise applicable to samples of dry vat-waste:—

(*a*). A known weight is dissolved in hydrochloric acid, the insoluble coke and sand collected on a weighed filter, and the carbon subsequently burnt off.

(*b*). In the filtrate from (*a*) the SO_4 is estimated by precipitation by barium chloride and weighing the $BaSO_4$.

(*c*). A known weight is dissolved in nitric acid, and the Cl determined volumetrically by a standard silver solution.

(*d*). A known weight is treated in Mohr's CO_2 apparatus; the ammonium carbonate found precipitated by boiling with calcium chloride; the precipitate washed till the washings are neutral, dissolved in a slight excess of standard hydrochloric acid, and the excess determined by a standard alkaline solution; thus the CO_3 can be calculated.

(*e*). A known weight is fused with four times its weight of a mixture of three parts dry sodium carbonate and one of potassium nitrate (both free from sulphate). From the total sulphate thus formed, and estimated gravimetrically by barium, that existing as Na_2SO_4 is subtracted, and the remainder calculated as S.

(*f*). A known weight is treated with hydrochloric acid, the filtrate oxidized by nitric acid, and the mixed $Fe_2O_3Al_2O_3$ and P_2O_5 precipitated by ammonia.

(*g*). The filtrate from (*f*) is treated with ammonium oxalate, the precipitate estimated volumetrically by permanganate, or gravimetrically as $CaCO_3$; hence the Ca known.

(*h*). A known weight is lixiviated with warm water, and in the filtrate from the insoluble matter the SiO_3 estimated by evaporation to dryness with hydrochloric acid; in the filtrate from this the Al_2O_4 combined as aluminate is determined by precipitating the alumina by ammonia.

(*i*). A known weight is cautiously treated with sulphuric acid in a capacious platinum crucible, and heated till gases cease to be evolved; the residue is treated with water, filtered and well washed, ammonia and ammonium oxalate added to the filtrate; and ultimately the total Na contained weighed as Na_2SO_4.

In calculating results from the foregoing data, the Cl found is calculated as NaCl, the SO_4 as Na_2SO_4, the SiO_3 as Na_2SiO_3, and the Al_2O_4 (soluble in water) as $Na_2Al_2O_4$; the remaining sodium is then calculated as Na_2CO_3, and the remaining CO_3 as $CaCO_3$. The sulphur is calculated as CaS, and the remaining calcium as CaO. From the total $Al_2O_3+Fe_2O_3+P_2O_5$ the alumina present as aluminate is subtracted; the coke and sand, &c., are directly determined (*a*). The difference from 100 in a carefully conducted analysis will not amount to more than a few tenths per cent, and represents cyanogen, traces of moisture, &c., and loss.

In an over-roasted ash the alkaline sulphide can only be safely estimated by digestion with nearly absolute alcohol, oxidation to sulphate by chlorine, and precipitation by barium. The Na contained as poly, or mono, sulphide, may be determined volumetrically by test acid in the alcoholic solution, and must be subtracted from that to be calculated as Na_2CO_3 as above: the S existing as poly, or mono, sulphide of sodium must be subtracted from the total sulphur found, the difference being calculated as CaS.

* *Annales de Chemie et Physique*, June, 1866.—Vide Chemical News, Nos. 345—347.

PARIS EXHIBITION OF 1867.

(From our Special Correspondent.)

Doubtless the majority of your readers imagine (if they ever took the trouble to think of the matter at all, which is not very likely) that the paths of a "special correspondent" are strewn with flowers. What has he to do but to examine, compare, and write the results in as decent English as he can command? This is very true; but has it never struck you, "gentle reader," that there is, to put it mildly, a tinge of sameness about all this examining, comparing, and writing? Your correspondent would not have alluded to the subject were it not that he has fallen a victim to another set of "*concessionnaires*." As long as one could take a chair outside the building and refresh oneself with a cup of coffee after the fatigues necessarily involved in the study of the productions of rival blacking and soda-water manufacturers, one's task was, although laborious, not without its redeeming points; but now that the chairs are removed, you must no longer expect the same regularity from your correspondent.

Our French friends here are in high glee about the Newton-Pascal affair. It will, indeed, need overwhelming evidence to disprove the mass of forged documents upon which the advocates of the Pascal theory rely. Unfortunately, the evil does not rest here. In this city there are a number of clever and not too scrupulous men of letters who delight beyond measure in mystifications of the Newton-Pascal type. Any great event in scientific, political, or artistic history is at once seized upon as a theme, and on it are erected a variety of literary edifices which, if not sound, are at least showy and attractive. To prove this it is only necessary to allude to the mass of forged letters of Marie Antoinette, upon which such opposite theories have been built. The affair of the necklace, the Man in the Iron Mask, Count Cagliostro, the Count

de Saint Germain, Madame de Brinvilliers,—I could for a thousand francs obtain documents to prove any theory connected with these highly promising subjects for the skill and inventiveness of literary charlatans. At a discussion the other day upon the affair of Newton, a French literary celebrity, pressed rather hard on the question of these forgeries, stated, with the entire concurrence of the Gallic element among his hearers, that France would soon prove to the world that *all* the greatest discoveries and the grandest ideas were French. "Your English writers, what are they but imitators of us? You have invented the word "adapted" to conceal your robberies from our dramatists, and now, not satisfied with "adapting" our dramas, you "adapt" our discoveries. Your Swift and your Sternes that you pride yourselves upon so much, have they not robbed from Rabelais? They should be kicked, especially your Sternes." The roar of laughter that arose from the English portion of his hearers so disconcerted the worthy professor, that "the sitting was suspended" for some minutes; but he enjoyed the explanation which followed so thoroughly that harmony was immediately restored.

To return to our work. Messrs. Burgoyne, Burbidges, and Squire, of Coleman-street, London, have a very handsome and well-arranged collection of drugs and chemicals. They are of very fine quality. They exhibit oil of bitter almonds both in the raw state and as freed from hydrocyanic acid. Their oils of cloves, carraway, pimento, nutmegs, cubebs, pepper, &c., are apparently as good as they can be. They, like the Messrs. Howard's, exhibit a fine specimen of benzoic acid; it is in a large globe, and has a very good effect. It is not made by direct sublimation, but by boiling the powdered gum benjamin with lime and water as long as any acid remains to be extracted. The solution is then precipitated with hydrochloric acid, and the resulting benzoic acid, after being separated by filtration from the solution of chloride of calcium, is dried and sublimed. They also exhibit white crystallised benzoic acid, prepared entirely by the wet process. This kind of acid is used in Germany, and is manufactured entirely for that market. Their cyanide of potassium, prepared by Liebig's process, looks well, and is stated by the makers to contain a very high percentage of pure cyanide. There is a sample of pure nitrate of barium, which they are now manufacturing in large quantities at the price of from £35 to £40 per ton. The chloride of barium is also manufactured by this firm in a pure state at £30 the ton. They also exhibit nitrate and carbonate of bismuth perfectly free from arsenic; and potassio-tartrate of antimony in crystals and in powder. The cubebin shown is prepared from the residue left in the still after distilling oil of cubebs. There are in this case two large specimens, about sixteen inches in diameter, of piperin and caffein. Piperin forms a very easily-broken crystalline mass, and the most extreme care had to be taken to get this fine preparation safely to the Exhibition. It was suspended by india-rubber springs so as to avoid concussion, and the arrangement was then hung in gimbals like a ship's compass. Owing to this careful packing it arrived safely, and without the mass losing a single crystal.

When we think how many fine specimens, not only chemicals, but also works of art, were destroyed in transit (some by careless packing, and still more by the brutally rough usage the packages containing them received), we cannot help expressing the hope that the skill and care shown in this matter by Messrs. Burgoyne and Co. will be imitated in future by some of those exhibitors whose despair, on unpacking their cases, was so ludicrously displayed.

The very complete collection of the scale preparations of iron exhibited in this case have suffered from the prolonged exposure to light which they have necessarily undergone, and have thus lost that beautiful colour and brilliant lustre which they possessed when they first arrived.

Among the other objects interesting to Pharmaceutists, are a collection of gelatine capsules containing balsam of copaiba, castor oil, oil of male fern, and sundry other unsavoury drugs. The exhibitors were induced to undertake the manufacture of these articles owing to the low character of a vast number of the capsuled preparations found in commerce. It is well known to those behind the scenes in these matters that, owing to the viscidity of the balsam of copaiba and oil of male fern, it is a common practice among unscrupulous makers to thin them down with linseed oil in order to facilitate the process of filling the capsules. The dilution of the active ingredients of the capsules which thus takes place is often so great as to render them entirely valueless as medicines.

Messrs. Burgoyne's case is one of the handsomest and best arranged in the English chemical department of the Exhibition, and, if it contains no great novelties, at least represents in a highly creditable manner the present state of English Pharmaceutical manufactures.

Messrs. Davy, Yates, and Routledge, of Upper Thames Street, London, have also an excellent display of drugs and chemicals. Their specimen of corrosive sublimate in a dome is adapted to show the fracture, and looks well. They also show calomel in a crystalline form as prepared by the old dry sublimation process, and also as sublimed in presence of steam. The first kind becomes discoloured on exposure to light, and sometimes retains traces of corrosive sublimate; the second is free from either of these defects. The ammonio citrate of bismuth is a comparatively new scale preparation. It is in the form of micaceous scales, containg sixty per cent of oxide of bismuth. The fact of its ready solubility in water without decomposition, and its being "compatible" with the alkalies and their carbonates, has made this salt a great favourite with many practitioners; and, indeed, in some stomach complaints this and other preparations of bismuth appear to act almost like a charm.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, Sept. 18, 1867.

Anti-incrustator for Steam Boilers.—Gifford's Monster Balloon.—Prize Subjects of the Haarlem Society of Sciences.—Fluorine Compounds, Isolation of Fluorine.—Potato Disease.—Preservation of Anatomical Specimens.—Report on Unity of Weights and Measures.

M. E. Schmitz exhibits an anti-incrustator for a steam boiler, composed of small surfaced curved blades, placed in contact one with the other in the same manner as curved tiles on the ridge of a house roof, in such a way that their *ensemble* forms a sort of double bottom in the boiler and in the generators. This double bottom only leaves a thin layer of water, of unequal thickness, absorbing the caloric, in consequence, under unequal conditions. The result is that the liquid particles are put rapidly in motion according to the difference of densities produced by the heat. The direction of the motion is transversal, and the circulation is caused to move upwards; on one side the steam, as soon as it is formed, while on the opposite side the water, less hot, descends to be vaporised in its turn. This circulation, which is very rapid and continuous, produces effects which annihilate completely the two causes of destruction.

The velocity of the liquid current is propagated throughout its entire mass, and determines a sort of molecular rolling which tends to take up the heat transmitted by the heated surface of the boiler, as quickly as it is formed. The liquid mass thus becomes the regulator of the heating of the metallic envelope which contains it, and, consequently, diminishes the causes of unequal dilations. By its rapidity, the current does not allow any matter to adhere to the surface of the boiler, and carries all impurities to the surface of the water,

where the steam is separated without peturbation. Thus the deposit takes place on the inner surface of the double bottom, and as there is always a current of water in contact with the bottom of the boiler, it can never get red hot. By the anticrustator of M. Schmidt the risk of explosion is considerably reduced.

The great news of the day is the inauguration on the 7th inst. of the anchored balloon of M. Henry Giffard, the celebrated inventor of the injector for steam engines. He has spent more than £4,000 upon the realisation of the greatest experiment of modern times. Having rented a plot of ground adjoining the extensive engine factory and machine works of M. Henry Flaud, he has erected an immense cylindrical screen of canvass fixed upon vertical poles. In this he has constructed a balloon 69 feet in diameter, holding 210,000 cubic feet of gas, formed of two webs of closely woven linen, cemented together by several layers of American black india-rubber varnish, the whole being covered with drying oil so as to prevent any of the effects of osmose or diffusion. Two series of gigantic apparatus have been constructed on the same spot, for the production of pure hydrogen. The first is composed of 100 barrels, each containing 155lbs. of dilute sulphuric acid, with a large quantity of iron turnings capable of furnishing, each, 350 to 400 cubic metres of gas. The second apparatus is a steam generator, by aid of which the steam is decomposed, by passing over red-hot charcoal or incandescent coke, into pure hydrogen and carbonic acid gas; the hydrogen is separated from the mixture by the aid of quick lime, which absorbs the carbonic acid gas and leaves the hydrogen pure, dry, and cool, to be conducted by a main pipe to the upper part of balloon. With this second series the hydrogen only costs two-pence per mètre cube (or about 4s. 9d. per 1,000ft.) but the preparations are not quite completed; in a trail on the 9th inst. the balloon was inflated with hydrogen resulting from the action of sulphuric acid, and the operation was finished in 8 hours, whereas the filling of the balloon with gas procured by the decomposition of water took 48 hours. The former process gave also 3,500 cubic feet of mother-water of sulphate of iron, collected in a vast subterranean basin, which can be sold to be evaporated by chemical manufactures, and which are sufficient to disinfect the cesspools of a whole quarter of Paris. Inflated on Saturday, the balloon had lost almost nothing of its gas on Monday, and on Thursday the 12th, when we visited it, the total loss of hydrogen was only 2,100 cubic feet, or a hundredth part of the total volume of gas with which the balloon had been inflated. The osmose or the diffusion is really prevented. The closing of the upper and lower valves, ingenious beyond description, is absolutely hermetical. We need scarcely remind our readers that the cable, 984 feet long, by which the balloon is attached to the earth, is coiled and uncoiled by two different steam engines, which the mechanician can stop or set at work at will by means of cocks which serve for the distribution of the steam.

The inflation being terminated, the balloon, containing 210,000 cubic feet of hydrogen gas, was retained by the ballast; at each of the 70 ropes of the group were attached ten sand bags weighing each 33 lbs.; and in spite of this weight of 22,100 lbs. the car was more than 3 feet from the ground, so great was the ascensional force. A rather strong wind, that may be estimated at 33 feet per second, was then blowing but it did not prevent the balloon from rising in a vertical direction. These experiments, suspended for some days, were to have been renewed on Saturday last. This organisation of a view of Paris from a height of 984 ft. reflects great credit on M. Giffard.

The Dutch Society of Sciences of Haarlem proposes for public competition the following subjects, the essays on which are to be deposited before the 1st January, 1869:—1. Profound researches on the nature of the infecting principle of the contagious typhus of cattle, indicating at the same time the prophylactic methods, the employment of which proceeds rationally from the result of these investigations. On account of the great importance attached to the solution of this first question by the Society, an extraordinary premium of five hundred florins will be added to the gold medal. 2. Detailed examination of the different substances composing the liquid produce of the dry distillation of coal. 3. The experiments of Mr. Tyndall have demonstrated that the intensity of sound differs considerably according as it is propogated in hydrogen or in atmospheric air, even when the densities of the two gases are equal; the Society demands, on this subject, comparative experiments made with at least three different simple gases. 4. To decide experimentally if the radicular extremities of plants exude matters capable of dissolving the silicic acid which is found in the ground in the shape of quartz. 5. New researches on the mutual decomposition of saline solutions containing different bases and acids which decide between the doctrine of affinities and that of Bergmann. 6. Ulterior exact researches on the remarkable phenomena of dissociation discovered by M. Sainte-Claire-Deville.

The chemical event of the last month has been the forwarding by M. Dumas, to the Academy of Sciences, of the researches of Mr. Prat on the chemical constitution of fluorine compounds and the separation of the fluorine. Mr. Prat started from this fact that the fluorides are really oxyfluorides; that the fluoride of calcium, for example, is formed of two equivalents of calcium, one of oxygen, one of fluorine, and that, in consequence, the true equivalent of fluorine is 29·5, and not 19, and that, in order to obtain it, all that is necessary is to treat the fluoride of calcium with chlorate of potassium, or, what is better, perchlorate of potassium, for it is only with this last salt that the reaction takes place. Oxygen is disengaged and a gas is produced which silver absorbs, giving rise to a fluoride of silver, insoluble in water, soluble in ammonia, from which it is precipitated by nitric acid, and which is altered by the action of light more rapidly than the chloride of silver; the formula of the real chloride is AgFl, whilst that of the soluble fluoride of chemists is AgFl.AgO. Fluorine is obtained by heating, in a platinum retort, fluoride of lead of the chemists one part, either with nitre five parts, or with binoxide of manganese two parts. Oxygen gas and fluorine are disengaged, the oxygen is taken up in its passage by fragments of heated baryta. Fluorine is gaseous, nearly colourless, possessing an odour like chlorine, very visibly giving off fumes in the air, incombustible, and heavier than air; it dissolves indigo, reddens and discolours litmus paper, disengages fumes in contact with ammonia, decomposes water at the ordinary temperature, combines with hydrogen under the influence of diffused light, and eliminates bromine and iodine from their compounds; it unites with boron, silicium, and all the metals of the first five groups.

MM. Juette and Ponteves have succeeded in preparing tartaric acid from the skins of grapes, after they have been pressed and distilled, and can be put to no use but as manure. After distillation the skins are treated with water so as to obtain lees, to which is added 2 per cent of sulphuric acid, and the mixture is boiled for some hours. The tartaric acid in combination is set at liberty, and, moreover, not only the sugar escaped from the fermentation is not eliminated, but the action of the sulphuric acid on the cellulose of the pulp of the grape forms a certain quantity of glucose. The liquor is allowed to ferment, and a supplementary distillation gives again an appreciable quantity of alcohol. When the decantation has been made, lime-wash is added, and tartrate of lime is produced, from which the tartaric acid is extracted by the ordinary method. According to the inventors the quantity of grape skins left after 1 million hectolitres of wine, treated by this process, would give 200,000 kilogrammes of tartaric acid the value of which is about 600,000 francs. (£24,000).

The Marquis of Havrincourt has addressed to the *Courier de Pas de Calais* the following letter: "M. Georges Ville, by following his very ingenious method of examining the vegetation of plants themselves, has just discovered the cause of the potato disease. The cryptogamia are the result and not the cause of the malady. Let any one go to the experimental grounds of Vincennes and he will be convinced as I have been. He will see there a plot of potatoes divided into five parts touching each other: the first is luxuriant and has not a sick leaf, the second is attacked by the malady; the third as the first; the fourth is as diseased as the second; and the fifth resembles the first and third. Thus M. Georges Ville produces or avoids the potatoe disease at will."

The following is the process of M. Von Vetter for the preservation of anatomical specimens:—Add to 7 parts of glycerine at 22° one part of raw brown sugar, and half a part of nitre till a slight deposit is formed at the bottom of the vessel. The portion required to be preserved is then plunged, dried or not dried, and it is left in the mixture for a time proportional to its dimensions; a hand, for example should remain eight days in the liquid; when it is taken out it is as stiff as a piece of wood, but if it be suspended in a dry and warm place the muscles and articulation recover their suppleness.

M. Jacobi has just issued his report on the Unity of Weights and Measures, drawn up in the name of the Commission of Moneys, &c., of the Exhibition.

On summing up, the commission think that the governments ought to keep the following objects in view:—The substitution, as soon as possible, but integrally, of the metric system as is practised in the west of Europe and in many other countries, in place of the old systems of weights and measures. This system introduced at once, and rendered legal but optional, cannot be rendered obligatory at first. The period of toleration varies with the state of the different people, their degree of instruction, &c., and it can only be determined by the governments. It has been remarked, however, that a too long delay does not perceptibly aid the governments in the accomplishment of their task. At all events, it is desirable that governments should take, henceforth, some necessary measures, which are—first, to order the study of the metric system in all schools, and to require a knowledge of it in public examinations; secondly, to introduce its exclusive use in scientific publications, public statistics, in post-offices, custom-houses, public works, and any other branches of the administration that the governments may deem convenient. The commission does not consider that it is part of its mission to occupy itself with the making of standards, exact copies of the prototypes of Paris, the possession of which, in a practical point of view, is the indispensable preliminary of every metrical reform. The administration of each country will appreciate the degree of exactitude suitable to the different destinations of these standards. F. Moigno.

REPORTS OF SOCIETIES.

ACADEMY OF SCIENCES.

Sept. 9, 1867.

(From our own Correspondent.)

The Pascal-Newton Forgeries.—New Compounds of Cyanide of Amyl.—Polarisation of Electrodes.

Let me say a few words on the answers of M. Chasles to the objections urged by M. Faugère, which had some appearance of gravity. The first was the allusion made in one of the letters written by Pascal, in 1652, about coffee and the froth of coffee. "Coffee," he said, "was not introduced into Parisian society before 1669, about seven years after the death of Pascal." Thus, without going further, M. Chasles finds in the Dictionary of Bouillet that coffee was drank in Venice in 1615, and at Marseilles in 1654; and in the new curious treatises on coffee, tea, and chocolate, published by Philip Sylvester Dufour, in 1684, we find "coffee has not been known in France for more than forty years." Subtracting these forty from 1684 we have 1644. Pascal, young, well acquainted with the world, and ardent in the advancement of progress, would not have been the last to have known the existence of coffee. Moreover, a forger, while treating on universal gravitation, would not have dreamt of connecting it with the froth of coffee.

To the second objection of the improbability of a correspondence between Pascal and Newton while children, as M. de Morgan and Sir David Brewster remark that he never knew French otherwise than with a dictionary, M. Chasles answers by presenting striking documents.

"PASCAL TO WALLIS.

"This 29th August, *apropos* of this young student (Newton), can you give me some tidings of him, and principally about his arrangements. Some friends assured me that the letters written by him to me, and the questions that he has submitted seem to have rather come from his professor than from him. I should like very much to have correct information. Perhaps you can give me a word about it? I am waiting for your reply."

"DESMAIZEAUX TO FONTENELLE.

"October 20, 1727.—This one (the Professor) advised his young pupil to write a letter to Pascal, and to submit to him some geometric questions or problems to be solved. It is the best way, said he, to obtain an answer. The letter was then prepared in concert with the Professor, as well as the questions, and sent by young Newton, yet a student, to M. Pascal. The latter finding, without doubt, the letter and questions extraordinary for a child, and recollecting, perhaps. that he himself had been a precocious child, ardent to learn, searching everywhere to instruct himself, replied to the young Newton. It was was thus that relations sprang up between the two men of genius, which lasted till the death of Pascal. I am perfectly sure that young Newton took part in it. It could not be otherwise. However, 'M. Le Chevalier Newton' has avowed it to me himself, thut it was these relations which engaged him to follow a scientific career."

Little satisfied with the peremptory answers of M. Chasles, M. Faugère returned to the charge and answered one by one his arguments without signification, insisting, above all, on the verification of the writing. Now, M. Chasles declared that he is ready to accompany him to the Imperial Library, in presence of the members of the Commission and the Academy who would wish to take part in it.

At the last meeting M. Dumas transmitted a second letter from Dr. A. W. Hofmann on a new compound of cyanide of amyl analogous to hydrocyanic acid. By pouring gradually a mixture of an alcoholic solution of ethylamine and chloroform into a retort containing pulverised hydrate of potash, a most energetic reaction takes place; the mixture becomes heated to the boiling point, and a liquid distils over, the penetrating odour of which surpasses all that can possibly be imagined. The liquid is the cyanide of amyl, transparent, colourless, lighter than water, insoluble in water, soluble in alcohol and ether, possessing an insufferable odour something like that of amylaceous alcohol and hydrocyanic acid. Its vapour possesses, in a higher degree than that of cyanide of phenyl, the property of leaving an intensely bitter taste on the tongue, and a suffocating feeling in the throat similar to that produced by prussic acid. It can be distilled without decomposition, and boils at 137°C. But little attacked by alkalies, it is decomposed by acids, with an almost explosive violence; a slight ebullition in pre-

sence of acidulated water is sufficient to transform it into formic acid and amylamen.

$$C_6H_{11}N + 2H_2O = CH_2O_2 + C_5H_{13}N$$
Cyanide of amyl. Formic acid. Amylamen.

At present M. Balard, by virtue of a note inserted in the *Comptes Rendus*, and the *Treatise on Chemistry*, of M. Naquet, claims the discovery of this new analogue of cyanhydric acid in favour of M. Armand Gauthier, laboratory pupil of M. Wurtz.

M. Gaugain presented a note on the polarisation of electrodes. Several savants have sought to determine the part which each of the electrodes takes in the polarisation, and have arrived at different results: M. Poggendorff found that the two electrodes contributed equally to the production of the electromotive force developed; MM. Lenz and Sawelgew found on the contrary that the part of the cathode is greater than that of the anode. M. Gaugain tried in his turn to resolve the question by making use, as he did on former occasions, of the *method of opposition*, and the following are the dispositions he adopted. In a cylindrical glass vase he placed a porous cylinder of much smaller diameter, and both vessels were filled with the same liquid. The strips of platinum which are to serve for the decomposition of the liquid are placed in the exterior vase, and a third plate of metal is introduced into the porous cylinder; this third plate, which remains constantly out of the circuit, traversed by the current, does not experience any polarisation, and can be successively compared with each of the electrodes when these are polarised to saturation; this comparison gives the measure of the two polarisations of the anode and the cathode. The porous diaphragm serves to keep the neutral plate out of reach of the influence of the hydrogen disengaged by the electrolysis.

The following are the results thus obtained by a series of experiments carried on with a mixture of nine parts by volume of distilled water, and one part of sulphuric acid.

Polarisation of the anode	193
,, of the cathode	157
Total polarisation	352

It appears to be of little consequence, if more or less sulphuric acid be added to the electrolysed water, provided that this proportion does not fall below a certain limit; but when it becomes extremely small the polarisation of the cathode increases without the polarisation of the anode being sensibly modified. The following are the results obtained by electrolysing pure water:—

Polarisation of the anode	193
,, cathode	243
Total polarisation	434

M. Matteucci recently (*Comptes Rendus*, Jan. 14, 1867) called the attention of the Academy to an experiment which he had made in 1838, and upon which he depended to prove that the polarisation proceeded from the gases adherent to the electrodes. In fact, polarised metals should be considered as fugitive combinations formed by the metals and gases, and the author is of opinion that in couples of polarisation as well as in Grove's gas pile, the electromotive force is the affinity exerted on one of the elements of the water by a gas associated in a particular manner to a metal.

The Magnesium Light.—We understand that this light is likely to play an important part in the Abyssinian expedition. Mr. Mellor, the manager of the Magnesium Metal Company, is prepared to supply several hundredweights of the powdered metal; and the authorities at Chatham have been for some time experimenting on the subject.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Ethers, Contribution to the History of.—Ch. Girard and P. Chapoteaut. If one equivalent of alcohol is mixed with one equivalent of stannic chloride, and rise of temperature has been guarded against, crystalline compounds are formed which are volatile almost without decomposition; they dissolve in water, and then decompose gradually, forming alcohol, chloride of alcohol-radical and stannic oxychloride. Heated with one equivalent of an alcohol they form ether and chloride of the alcohol employed, besides stannic oxide, and chloride. The formula of the ethyl-compound is $C_4H_5,HO,SnCl_2$. Alcalic hydrates decompose them into alcohol and stannic oxide, and boiling alcohol into ordinary or mixed ether. These reactions show that the part taken by stannic chloride in the formation of ether is similar to that of sulphuric acid, and this is still more apparent if the action of stannic chloride on mixtures of acids and alcohols is considered; in this case the compound of alcohol and stannic chloride, originally formed, acts upon the acid and produces by mutual decomposition the mixed ether. The authors have in this way prepared the methylic, ethylic, and amylic ethers of formic, acetic, tartaric, lactic, butyric, benzoic, palmitic, and stearic acid. The action of stannic chloride is explained in the following equations.

1. On alcohols (ethylic alcohol as example)

$$C_4H_6O_2 + SnCl_2 = C_4H_5O,SnCl_2,HO$$
$$C_4H_5O,SnCl_2,HO + C_4H_6O_2 = 2(C_4H_5O) + (SnCl_2,2HO);$$

2. On a mixture of alcohol and acid (ethylic alcohol and acetic acid as example)

$$C_4H_6O_2 + SnCl_2 = C_4H_5O,SnCl_2,HO$$
$$C_4H_5O,SnCl_2,HO + C_4H_3O_3,HO = C_4H_5O,C_4H_3O_3 + (SnCl_2,2HO)$$

(*Comptes R.* lxiv. 1252.)

Synthesis of Methylallyle.—A. Wurtz. It has been shown by the author, some years ago, that the action of zincic ethyde upon allylic iodide gives rise to the formation of ethylallyle $= \begin{matrix} C_3H_5 \\ C_2H_5 \end{matrix}$ which is isomeric with amylene. Zincic ethyde and brominated propylene scarcely act upon each other, either in the cold or at an elevated temperature; nor do zincic methide and allylic iodide. But if, in the latter case sodium be added and the temperature raised to 120°, an energetic reaction takes place, in course of which a very volatile hydrocarbon is formed, which, combined with hydriodic acid, has the composition C_4H_8,HI. A more ready method to obtain this body is the following: A mixture of methylic and allylic iodide, diluted with twice its volume of dry ether, is heated together with sodium to 100° for several hours in sealed vessels. After the completion of the reaction, the contents of the vessels are distilled, the distillate saturated with bromine, the excess of the latter removed by potassic hydrate, and again distilled. When all the ether has gone over, the distillation is continued in a vacuum and stopped when the temperature reaches 100°. The residue sodidifies on cooling and consists of diallylic tetra-bromide, the portion distilled off is subjected to repeated fractional distillations, and finally a colourless bromide is obtained. This bromide is readily decomposed by sodium and the hydrocarbon $C_4H_8 = \begin{matrix} C_3H_5 \\ CH_3 \end{matrix}$ formed which is a gas at ordinary temperatures, but may be condensed to a liquid by being cooled to −12°; it then boils between −4° and +8°. The hydriodate of methylallyle boils between 116° and 118°.

Butylenic hydriodate, although of the same boiling-point and sp. gr., is not considered by the author to be identical with the former, on account of the hydrocarbon having a considerably lower boiling-point.—(*Comptes R.* lxiv. 1088.)

CORRESPONDENCE.

GAS FROM IRON.

To the Editor of the Chemical News.

Sir,—In the valuable article of Dr. E. G. Tosh, "On the Analysis of Cast Iron" (vol. xvi. p. 94), mention is made of the observation of Schnitzler that in Weyl's process for the estimation of the carbon, bubbles of gas are evolved from the metal during solution. Rather than entirely accept the explanation proposed by the author, or entertain that of Schnitzler, I am more inclined to venture to draw attention to another possible explanation. I have noticed that under similar circumstances, gas is disengaged from thin iron wire, and it struck me as being the natural gas occluded by the metal. May it not be so with the cast iron? In the *Journal Chem. Soc.* (vol. v. p. 287), Graham states wrought iron probably carries about 6 or 8 times its volume of occluded carbonic oxide, and as much as 12·55 volumes of natural gas have been extracted; now according to this 4 grains cast iron, say of 7·5 sp. gr., might contain from 3·18 c.c. to 4·24 c.c. or even as much as 6·36 c.c. of a mixture of hydrogen and carbonic oxide, the former varying in the proportions of 21 to 35 per cent, that is, supposing cast iron to occlude gases in the same way as wrought, which I believe has not yet been shown, and from its crystalline nature might not be anticipated. Nevertheless we find that white variety of cast iron is of a pasty consistence when fused, and the grey iron is always of a porous nature, conditions which lead one to expect them to have the property of occlusion; further, Deville has extracted carbonic oxide from a cast steel tube. The gas which escapes during electrolytic solution has a peculiar odour, so also has that naturally occluded by malleable iron.—I am, &c. Walter Noel Hartley, F.C.S.

September 3, 1867.

BAKING POWDERS.

To the Editor of the Chemical News.

Sir,—In a recent number of the Chemical News you published some remarks on the above subject from your Paris correspondent; the paragraph was copied into various journals, and as the remarks referred to are calculated to mislead the public, perhaps you will allow me to say a few words on the subject.

The question as regards "baking powders" does not relate to their composition so much as to their excessive use as a substitute for more proper ingredients; carbonate of soda, tartaric acid, and a small proportion of rice-flour, which form the compound, are so inexpensive that there is no temptation to the manufacturer to employ inferior or cheaper articles, if even they could be found. There exists, therefore, no necessity for those prominent warnings, which are continually published, against "imitations," of certain baking powders; but the public need guarding against the belief, that these powders can adequately supply the place of butter and eggs in pastry and puddings.

Baking powders may be perfectly genuine and proper as far as they go, but they must be pernicious to health if used habitually as a substitute for the nutritious elements which ought to have a place in articles of daily food.

The sum total of the matter is this, that baking powder may be perfectly genuine and harmless in themselves, but they become injurious to health if employed to adulterate food into which they are introduced.

I do not deny that a small porportion of baking powder may be used with advantage in pastry *in addition* to the usual ingredients, but not as a substitute for any of them; and this is all that can be said in favour of the compound.—I am, &c. Sanitas.

September, 1867.

MISCELLANEOUS.

In Memoriam.—Faraday.—In his introductory address to Section A of the British Association, the President, Sir William Thomson, said:—It was my intention not to detain you from the interesting subjects and abundant matter for discussion which will so fully occupy our time during the meeting, by an introductory address; but I must ask you to bear with me if I modify somewhat this resolution, in consequence of a recent event, which, I am sure, must touch very nearly the hearts of all present, and of very many in all parts of the world, to whom the name of Faraday has become a household word for all that is admirable in scientific genius. I wish I could put in words something of the image which the name of Faraday always suggests to my mind. Kindliness and unselfishness of disposition; clearness and singleness of purpose; brevity, simplicity, and directness; sympathy with his audience or his friend; perfect natural tact and good taste; thorough cultivation—all these he had, each to a rare degree; and their influence pervaded his language and manner, whether in conversation or lecture. But all these combined made only a part of Faraday's charm. He had an indescribable quality of quickness and life. Something of the light of his genius irradiated all with a certain bright intelligence, and gave a singular charm to his manner, which was felt by every one, surely, from the deepest philosopher to the simplest child who ever had the privilege of seeing him in his home—the Royal Institution. That light is now gone from us. While thankful for having seen and felt it, we cannot but mourn our loss, and feel that whatever good things, whatever brightness, may be yet in store for us, *that* light we can never see again.

An American View of English Patent Law.—We quote the following from our talented contemporary, *The American Journal of Mining*. From the amusing illustration quoted in the latter part, it would appear that the American patent laws are at least as elastic as our own. "The Chemical News describes, with well-merited ridicule, an apparatus patented Oct, 1866, in England, for the generation of 'vital force' by the contact of 'an azote and a carbonated body.' The extract will be found in another column. The News justly says, 'a more powerful satire on the present state of the patent laws we have never seen. The patent laws of England are perhaps more absurd than that of any other country. They date back to a period when it was desired to transplant into England the secrets of European manufacturers; and they were primarily intended to reward those enterprising individuals who should courageously spy out the discoveries which others had made, and then, with sudden virtue, wish to be protected in their rights to the stolen property. If we mistake not, it is still a feature of the English system, that the patentee need not claim to be the original inventor, and that foreign inventors have no rights which patentees are bound to respect. A natural consequence of this fundamental injustice is an extreme looseness in the administration of the patent laws. It is proverbial that anything can be patented in England. The governmental examination amounts to little or nothing. The records show many cases of the same inventions repeatedly patented by different parties; of patents covering only elementary principles, which have long been public property; and of preposterous bits of quackery like this "battery of vital force," receiving the sanction of parchment and the royal seal. We pride ourselves on our superior system; but is it free from similar faults in administration? It is certain that our citizens would be saved much perplexity, and our courts much vexatious business, by a stricter examination of patents in the beginning by the government officials. As an offset to the amusing instance presented by the *News*, we might mention an American patent, obtained a year or

two ago, for preserving the bodies of deceased relatives, by subjecting them to hydraulic pressure, for the purpose of expressing all moisture! We should like to submit a body, prepared by *our* patent, to the inventor of 'vital force,' and see whether, by the application of azote and carbon, he could 'bring it to!'"

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Comptes Rendus. June 10, 1867.

BOUSSINGAULT, "On the Decomposing Action of a High Temperature on some Sulphates." PAYEN, "On the Structure and Constitution of Ligneous Fibres, followed by an Account of the Methods of manufacturing Paper from Wood.', A. DE LA RIVE, "On the Electrical Condition of the Earth." L. SIMONIN, "On the Bituminous Schists of Vagnas, in the Department of Ardeche, France." CHACORNAC, "On the Periodicity of Sun Spots." P. VOLPICELLI, "On the Determination of the Poles of Bar Magnets." S. DU LUCA AND J. UBALDINI, "Researches on the reciprocal Action of Sulphurous Acid and Sulphuretted Hydrogen." C. FORTHOMME, "Remarks on M. Perret's Improved Wine Fermenting Vat."

Annalen der Chemie und Pharmacie. June, 1867.

A. NAUMANN, "On the Specific Heat of Gases for equal Volumes under Constant Pressure."—"On the Velocity of the Movements of Atoms." E. RUBIEN, "On Œnanthylidene and Caprylidene." P. JANASCH, "On Trichlorodracylic Acid."—"On Trixylylamine." O. PIEPER, "On a Chlorinated Derivative of Toluol." A. BAEYER, "On Neurine."—"A Lecture Experiment demonstrating the Action of Nitric Acid on an alcoholic Solution of Propargylic Ether." C. GRAEBE, "On a new Method of Forming Methylsalicylic Acid." C. GRAEBE AND O. BORN, "On Hydrophthalic Acid." C. GRAEVE AND O. SCHULTZEN, "On the Behaviour of the Aromatic Acids in their Passage through the Body."—"On Methoxybenzoic Acid." H. HLASIWETZ, "On the Hydrocaffeic and Hydroparacoumaric Acids."

Dingler's Polytechnisches Journal. May 2, 1867.

C. SCHINTZ, "On J. Lundin's Improved Regenerative Gas Furnace."—"On the Calorific Value of Austrian Coals." R. WEBER, "Contributions to the Knowledge of the Manufacture of Sulphuric Acid in Lead Chambers." P. BUCHNER, "On the Estimation of Tannic Acid in Oak Bark." J. MALMEDIE, "Apparatus for Bleaching Flax Yarns." A. LIELEGG, "On the Spectrum of the Flame from Bessemer Convertors."

May 18.

G. SCHNITZER, "Analyses of Bauxite from Austria." P. BUCHNER, "On the Estimation of Tannic Acid in Oak Bark." J. C. LERMER, "On the Destruction of Wooden Brewing Utensils by Fungi." H. DUFRENE, "On Rousseau's Improvements in Treating Beet Juice with Lime." C. KURTZ, "On the use of Canada Oil as a Substitute for Bisulphide of Carbon in the Extraction of Oil from Seeds." J. STINDE, "On the Preparation of Spirits of Nitre." O. REINSCH, "On Colouring Thin Sheets of Metal, and rendering Membranes, Fabrics, and Glass iridescent." CORDURE, "A Method of obtaining Silver from Argentiferous Lead by means of Zinc." CLEMANDOT, "A new Silica Glaze for Pottery Ware." B. HOFFMANN, "Some remarks on Ozokerite."

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2102. C. King, Regent Street, W., "An improvement in the preparation of chocolate and cocoa." Petition recorded.—July 17, 1867.

2410. J. G. Marshall, Leeds, "Improvements in solvent or detergent processes."—August 22, 1867.—Invention protected by the deposit of a complete specification.

2453. J. Storey and W. E. Bickerdike, Lancaster, and W. V. Wilson, Jubilee Street, Mile End, Middlesex, "A new method of bronzing metallic and other surfaces."—Petition recorded.—August 28, 1867.

NOTICES TO PROCEED.

1190. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the treatment of peat, and in the manufacture of peat charcoal, and in the machinery or apparatus employed therein."—A communication from A. Frigge, Hanover.—Petition recorded.—April 24, 1867.

1212. E. Guenin, Henrietta Street, Covent Garden, Middlesex, "Improvements in the preparation and application of mustard for curative purposes."—A communication from P. Rigollot, Paris.—April 26, 1867.

1512. J. Stenhouse, Rodney Street, Pentonville, Middlesex, and J. Duncan, West Ham, Essex, "Improvements in the treatment of animal charcoal, and in the apparatus employed therein."—May 21, 1867.

2420. W. R. Lake, Southampton Buildings, Chancery Lane, "Improvements in the manufacture of iron and steel, and apparatus employed in the said manufacture."—A communication from W. W. Blanchard, Bridport, Vermont, U.S.A.—August 23, 1867.

NOTES AND QUERIES.

Electro-magnet.—Sir,—Can any fellow-reader of the CHEMICAL NEWS tell me if there is any great disadvantage in using cast-iron instead of soft wrought iron for the core of an electro magnet? For the purpose to which I wish to apply it a little residual magnetism will do no harm.—C. LINLEY.

German Yeast.—Sir,—Can any one put me in the way of obtaining any information respecting the particulars of the manufacture of German yeast? The supply, originally obtained from the Schiedam Vats, has failed to keep pace with the demand, and I believe it is now specially prepared for the market.—F. IRELAND.

Another Specific Gravity Problem.—Sir,—Perhaps one of your obliging correspondents would point out the shortest way to solve the following:—"How much of a liquid whose s.g. is 1,000, must be added to 1,000 grain measures of a liquid whose s.g. is 1,314, to reduce its s.g. to 1,286, supposing no change to take place on mixture which would vitiate the result of the calculation, that is to say, supposing the bulk of the mixture to be the sum of the bulks of the two liquids mixed."—HENRI DU CHEMIN-CREUX.

Quinine.—Sir,—Could you, or any of the readers of your paper, oblige me by informing me "how to re-dissolve quinia, which has been precipitated in the course of manufacturing ferri citr. c. quinæ, by an excess of liq. ammon. fort., in a warm solution?" An addition of more citric acid has no effect upon it.—E. S.

Aneroid.—The word *aneroid* is a contraction of *anaëroid*, derived from *αηρ*—air—and the *'α* privativum—meaning a barometer founded on the action of the pressure of air on a tube, from which the air has been exhausted. It was first constructed by Vidi, and improved by Bourdon, whose well-known steam-gauges are on the same principle.—G. L.

Table of Densities.—Sir,—Could you inform me where I can purchase a table giving the decimal weight per cubic inch of sulphuric acid at the different specific gravities?—GEORGE K. BOWNTIFF.

Testing Cognac.—Sir,—Can you tell me whether it be possible by chemical analysis to distinguish real Cognac from spirits of wine made into so-called Cognac by the addition of "flaveur de Cognac," or "essence de Cognac?"—C. CAMPBELL.

TO CORRESPONDENTS.

J. P., Shire.—Any wholesale chemist will supply you with bisulphite of soda. Be careful to get the bisulphite, not the bisulphate.

E. Ellis.—It is not our province to give the information you ask. Many so-called depillatories are to be met with in commerce, but there is risk attending their employment.

F. C. S.—1. "Watts's Dictionary," under the heading Phenol (a synonym), gives a very good account of the preparation and purification of carbolic acid. As for its properties, you cannot have a better account than that given in our own "Cattle Plague Report," published at the CHEMICAL NEWS Office. 2. Consult Bowditch's Analysis, &c., of Coal Gas, or Sugg's "Gas Manipulation."

C. Campbell.—To make permanganate of silver the two solutions must be quite saturated; the equivalents are easily calculated.

J. C. B.—The alteration is unimportant.

Tyro.—The increased temperature of the soapy water is evidently due to the friction in the process of washing, and the warmth communicated to it by the hands.

H. K. Bamber, F.C.S.—Your communication has been carefully considered, and steps will be taken to diminish the abuse likely to arise.

Communications have been received from Edwin Smith (with enclosure); D. J. O.; Abbé Moigno; Thomas Anderson; A. Scott (with enclosure); W. Hartley (with enclosure); J. Heywood (with enclosure); F. C. Calvert, F.R.S; F. Muspratt; Harry Taylor; — Warrington; J. Turner (with enclosure); Peter Squire; G. Worsley; Jabez Hughes (with enclosure); A. Brown (with enclosure); H. Gillman (with enclosure); Edward Beanes (with enclosure); F. J. Booth; J. Mercer (with enclosure); W. Herapath, F.C.S. (with enclosure); A. Gow (with enclosure); J. C. Braithwaite (with enclosure); "Rusticus" (with enclosure); F. Ireland (with enclosure); W. B. Giles (with enclosure); J. T. Bouck (with enclosure); B. W. Gibsone (with enclosure); John Cliff (with enclosure); W. L. Lindsay; M. A. Baines (with enclosure); A. Dalziell; W. Bywater; W. Ladd; C. A. Wright; W. J. Morgan (with enclosure); Nicholson and Maull; E. A. Parnell (with enclosure); Dr. Anderson; Charles A. Wright; J. M'Kenny and Co.; A. M'Leod; E. Ellis; J. Carter Bell; W. Skey (with two enclosures); H. K. Bamber; T. Macfarlane; W. Herapath, senr; Dr. Day; F. J. Booth; H. Merton (with enclosure); W. Hooper (with enclosure); Peter Spence (with enclosure); M. Khanikof; C. Tomlinson, F.R.S. (with enclosure); Professor A. H. Church (with enclosure).

Books Received.—"Analysis of a Biliary Concretion; and on a new method of Preparing Biliverdin."—By Dr. Phipson, F.C.S. "The Relief of Pain by the Use of Metallic Tractors." "Catalogue of the Library of the late Dr. Richardson." "A Dictionary of Chemistry." Part xli. "Intellectual Observer." "Experiments on the Removal of Organic and Inorganic Substances in Water."

SUPPLEMENT
TO THE
CHEMICAL NEWS.
Vol. XVI., No. 407.

ON THE ECONOMISATION OF SULPHUROUS ACID IN COPPER SMELTING.*

By PETER SPENCE, F.C.S.

It will be in the recollection of members of this Section that Lord Derby, in 1861, obtained the appointment of a committee of the House of Lords, for obtaining evidence as to the noxious vapours from chemical works, &c. That investigation, carried over many months, resulted in the passing of what is called the "Alkali Works Act," and which has been so ably and successfully carried out by my friend Dr. Angus Smith.

At the same time a large amount of evidence was taken as to the emission of sulphurous acid, and arsenious acid, from the copper smelting works at Swansea, and other parts of the country; but no legislation was adopted, because, with the exception of the writer of this paper, all the witnesses testified to there being no practicable means of suppressing the nuisance without destroying the trade.

Copper smelting as now conducted appears at first sight a very crude, but is in reality a very beautiful, chemical process. The ores used are of a heterogeneous character, chiefly iron pyrites more or less impregnated with copper, and containing besides arsenides and sulphides of various other metals, with a large mixture of quartz. The first process of the copper smelter is by calcination to separate a quantity of the sulphur and as much as possible of the arsenic; for this purpose the mixed ores are exposed to a red heat, and these bodies are dissipated into the atmosphere. When calcined the ores must still retain a portion of the sulphur, varying with its richness in copper, this sulphur playing an important part in the next operation. The calcined ores are now melted down by great heat into a fluid state, when the sulphur not dissipated unites with a portion of the iron and every trace of the copper, for which it has great affinity, and sinks to the bottom of the furnace, carrying down with it any of the precious metals which may be present. The large mass of the fluid now floating at the top is silicate of iron, and is skimmed off and thrown away as slag. The *regulus* run from the bottom of the furnace contains from 20 to 35 per cent of copper, and almost invariably 28 per cent of sulphur. The *regulus* is again calcined to throw off the sulphur, and the subsequent processes of refining take place.

I effect the saving of sulphur by calcining in long furnaces, the bed being heated from below, air being made to travel from one end of the furnace to the other over the heated ore, the air and SO_2 being passed from the furnace directly to the lead chambers, the ore being at regular intervals made to traverse in an opposite direction coming out calcined where the air enters. The calcination of *regulus* is exactly similar in both cases, the calcination is only carried to a certain point, 8 to 9 per cent of sulphur being left in both the ore and regulus.

This process, carried out for several years chiefly in vitriol works, is now being successfully employed by the Goole Alum Smelting Company, on a large scale as a copper smelting process. It has been in operation there for over twelve months, and at present 150 to 200 tons of mixed ores are being smelted weekly. These ores are Cornish, Swedish, Norwegian, and Spanish.

* Read before the British Association, in Section B.

About two months ago I sent down one of my chemical assistants to superintend during a month some large working experiments, analysing the results at every stage, so that reliable data might be got. One of these experiments I append, and as it is typical of the general operations, it may safely be taken as indicating what is being done.

10½ tons Cornish ores containing 19 per cent sulphur
13½ ,, Spanish smalls ,, 47 ,, ,,

	Sulphur. tons.cts.qrs. lbs.
{ mixture } { 33·3 per cent } =	8 0 0 0
This was calcined, the SO_2 going to the vitriol chamber. The result was 22 tons of calcined ore, containing 8 per cent sulphur	1 15 0 0
The ore when smelted gave 2 tons 15 cwt. of regulus containing 28 per cent sulphur	0 15 1 20
The loss in sulphur dissipated is therefore ..	0 19 2 8
This regulus calcined, the SO_2 going to the vitriol chamber became 2 tons, 10 cwt., containing 9 per cent of sulphur	0 4 2 20
No more sulphur can be economised, therefore the total loss of sulphur is	1 4 1 0

Or as under,

Sulphur economised	84·8 per cent
Sulphur lost	15.4 ,,
Total sulphur in ore	100·0

ON A NEW TELEGRAPHIC THERMOMETER.*

By PROFESSOR WHEATSTONE, F.R.S.

The telegraphic thermometer which I constructed in 1843, and which is described in the report of the thirteenth meeting of the British Association, depended on the simultaneous action of two isochronous chronometer or clock movements—one at the remote station regulating the motion of a plunger in the bore of a thermometer, and the other at the near or observing station, marking, by the motion of the needle of a galvanometer, the moment at which the contact of the plunger with the mercury of the distant thermometer completed or broke the circuit. The clock movements required to be periodically wound up, and therefore the affected instrument could not be left to itself for an indefinite time. There are, however, many situations in which it might be desirable to have meteorologic indications when the instruments would not be accessible for very long periods. I have, therefore, devised a new class of telegraphic meteorometers which shall be independent of clock work, and may remain in any situation of difficult access as long as the instrument endures. This principle is applicable to all instruments which indicate by means of a revolving hand, and I have already devised its application to a Breguet's metallic thermometer, an aneroid barometer, and a hygrometer, depending on the absorption of moisture by a thin membrane. It is also applicable to a bar magnet in a fixed position, and to a variety of other indicators. The apparatus consists of two distinct instruments connected only by telegraphic wires. The first I will call the questioner (A), the second the responder (B). The questioner (A) is a rectangular box, presenting externally a circular dial face, round which are engraved the degrees both of the Fahrenheit and Centigrade thermometric scales, the former ranging from 20° below zero F. to 220° above that point, and the latter from 0° to 110° C. It shows, besides, three binding screws for the purpose of connecting the telegraphic wires, and a handle which causes the rotation

* Read before the British Association, in Section A.

of the armature of a magneto-motor in the interior. This magneto-motor is similar in its construction to that employed in my alphabetic magnetic telegraph; a soft iron armature rotating before the four poles of the magnet occasions, when the circuit is completed, alternate currents of equal intensity. The box also contains a small electro magnet, which acts by means of mechanism similar to that employed in the indicator of the aforesaid telegraph, and causes the revolution of the index of the dial. The responder (B) is a cylindrical brass box, which presents on its upper surface a similar dial, with its thermometric scales and index; at its base three binding screws, corresponding to those of the questioner, are fixed for connecting the telegraphic wires; and it is furnished with a brass cover that it may be hermetically sealed when lowered in the sea or buried in the ground. Its interior contains three essentially distinct parts.—1. The metallic thermometer, which consists of a spiral ribbon of two dissimilar metals, with its hand capable of ranging through the extent of the circular thermometric scale of the dial;—2. A small electro-magnet, acting by means of a propelment on a disc, making as many steps in one rotation as there are half-degrees on the scale; 3. An axis to which is fixed a delicate spiral spring, which causes a pin to bear lightly against the hand of the thermometer however it may vary in position. The two instruments are connected by means of two telegraphic wires. The first proceeds from an earth plate at the near station, passes through the coil of the electro-motor in A, joins the coil of the small electro-magnet in B, and then proceeds to another earth plate at the distant station. The second wire is permanently connected with the first between the earth plate and the coil of the magneto-motor, and includes that of the electro-magnet in B, and its opposite end is brought close to the remote end of the first wire. The mechanism is so disposed that when the first wire is disconnected from its earth terminal it is brought into circuit with the second wire. By this arrangement, when the dial of A is brought to o° and the handle turned, at the first moment the circuit is completed through the first wire, containing the coil of the electro-magnet in B, and the return earth. A disc is thereby caused to revolve in an opposite direction to the graduation of the scale until a pin, originally starting from o°, comes into contact with the pin, pressing against the thermometer hand, and thereby completes the circuit of the second wire, and breaks the connection with the earth plate. At first only the electro-magnet in B is acted upon, but when the currents are diverted into the new channel both the electro-magnets act simultaneously. In consequence of the action of the electro-magnet in A, the hand of its dial passes over a space corresponding with that between o° and that indicated by the thermometers and the hand of the dial ultimately accords with that of the distant thermometer. When the hand of the dial on A comes to rest the disc in B arrives at o°, and a catch permits the spiral spring to unwind itself, and its pin flies to and presses against the thermometer-hand. It must be observed that instruments thus constructed are not capable of marking every possible gradation; but they may be made to indicate divisions of the scale of any required minuteness. It is advisable to limit the extent of the scale when more minute divisions are deemed necessary. The only circumstance that can affect the accuracy of the indications of the instrument is this—the pin pressing against the thermometric index displaces it a little, and causes it to assume a position about a degree in advance; but as this pressure is a constant one, the inconvenience is remedied by a slight corresponding shifting of the scale. In this class of instruments the indications are not spontaneously conveyed to the observer, but they must be asked for, and whenever this is done the indications will be immediately transmitted to him however frequently the question is put. The uses to which this telegraphic thermometer may be applied are, among others, the following:—The responder may be placed at the top of a high mountain and left there for any length of time, while its indications may be read at any station below. Thus, if there should be no insuperable difficulties in placing the wires, the indications of a thermometer placed at the summit of Mont Blanc may be read as often as required at Chamouni. A year's hourly observations under such circumstances would no doubt be of great value. If it be required to ascertain during a long-continued period the temperature of the earth at different depths below its surface, several responders may be permanently buried at the required depths. It will not be requisite to have separate questioners for each, as the same may be applied successively to all the different wires. The responder, made perfectly water-tight, in which there would be no difficulty, might be lowered to the bottom of the sea, and its indications read at any intervals during its descent. In the present mode of making marine thermometric observations, it is necessary that the thermometer should be raised whenever a fresh observation is required to be made.

ON THE PRESENCE OF COLUMBITE IN WOLFRAM.

By T. L. PHIPSON, Ph.D., F.C.S.

I HAVE recognized the presence of columbite (niobate of iron and manganese) in a sample of wolfram from Auvergne that I have lately analysed, which was given to me some years ago by M. Pisani. I had already remarked that wolfram from different localities sometimes contained niobic acid, sometimes tantalic acid, which can be made distinctly evident by examining before the blow-pipe the residue left when most of the iron, manganese, and tungstic acid, have been separated.

From the specimen here in question I succeeded in extracting from some twenty grammes a quantity of columbite sufficient to fill a small bottle, and to enable me to study its properties easily. The separation of this rare mineral is based upon the simple fact that wolfram is attacked by aqua-regia, whilst columbite is not. Fifteen to twenty grammes of wolfram, finely pulverized, are attacked by warm aqua-regia, and when the action has proceeded as far as possible the residue is collected, the tungstic acid separated by a solution of ammonia, and the residue again submitted to the action of aqua-regia. These operations are repeated five or six times, as long as any tungstic acid can be obtained from the residue. Finally, the latter becomes quite black, and then consists almost entirely of the mineral columbite (or niobite) mixed with some grains of transparent quartz.

After ascertaining by analysis the nature of this residue I passed it under the microscope, and saw the mineral in its ordinary aspect. It appeared in the form of angular, irregular, black fragments, more or less metallic, almost vitreous, non-magnetic, resembling up to a certain point brilliant fragments of coal; and giving all the blow-pipe reactions of columbite.

It will be remembered that M. Gustav Rose formerly ascertained that columbite and wolfram are isomorphous.

I may profit by this opportunity to state that the metal columbium, now called *niobium*, was discovered by the English chemist Hatchett in 1801, and that the metal discovered in 1802 by Ekeberg, and called *tantalum*, was really a new metal, and not the columbium of Hatchett, as Dr. Wollaston declared. The latter is niobium, a metal which has become remarkable by the persevering researches of Heinrich Rose, who has made known all its characteristic reactions. On comparing the observations of Hatchett with what is now known of tantalum and niobium, principally by the admirable analytic studies of Heinrich Rose, the fact alluded to becomes, I believe, incontestable.

London, Aug. 31, 1867.

ON THE ELECTRICAL RESISTANCES OF THE FIXED AND VOLATILE OILS *.

By T. T. P. BRUCE WARREN.

THE want of an acknowledged and reliable means of recognising the purity or condition of samples of oils has long been felt by pharmaceutists. No tests, or system of tests at present used are free from objection. An inspection of the optical characters of the oils, whether fixed or volatile, will be sufficient to confirm the truth of this observation.

The polariscope has at best a very limited scope of application, whilst the determination of the refractive or dispersive qualities requires such precise adjustments that the suitability either of the one or the other for the purposes of a technical test may be fairly questioned. The refractive power of the oils, both fixed and volatile, has so small a variation, even between the too extremes of the scale here given, that the difference produced on the refractive power of any oil by the addition of a small quantity of another, would be barely perceptible. The objection against the measurement of the dispersive action as a means of expressing the value of an oil, is that the determination of the differences of indices of refraction for the extreme rays is at once tedious and unreliable; the scale of dispersions offers, however, a much wider range of differences.

It is probable that the comparison of two samples of oil by the irrationalities of their dispersion is worthy of some attention. I am not aware of its being applied as a test, but the samples could stand side by side with respect to the illuminating source, and their spectra projected side by side could be easily observed and compared.

The tables here given of the dispersive powers, and the irrationalites of dispersions, are by Sir David Brewster; the refractive powers are principally by the same authority.

OPTICAL QUALITIES OF OILS.

Name of Oil.	Index of Refraction.	Dispersive Power.	Difference of Index of Refraction for extreme rays.
Anise	1·601	·077	·044
Almond bitter	1·603	·079	·048
Almond sweet	1·483	—	—
Angelica	1·493	·051	·025
Bergamott	1·471	—	—
Cassia	1·641	·139	·089
Carraway	1·491	·049	·024
Castor	1·490	·036	·018
Camomile	1·457	—	—
Cloves	1·535	·062	·033
Cumin	1·508	·065	·033
Dill	1·477	—	—
Fennel	1·506	·055	·028
Juniper	1·473	·047	·022
Lemon	1·476	—	—
Lavender	1·462	—	—
Nutmeg	1·497	—	—
Olive	1.470	·038	·018
Poppy	1·463	—	—
Pennyroyal	1·482	—	—
Peppermint	——	—	—
Rape-seed	1·475	—	—
Sassafras	1·534	·069	·032
Spearmint	1·481	·054	·026
Alcohol	1·372	·029	·011
Turpentine	1·475	·042	·020

* Read before the British Association in Section B.

Table of Oils.—Arranged in order according as they contract the less refrangible, and expand the more refrangible spaces (irrationalities of dispersion).

Oil of Cassia	Oil of Nutmeg
,, Bitter Almonds	,, Peppermint
,, Aniseed	,, Castor
,, Sassafras	,, Nut
,, Fennel	,, Olive
,, Cloves	,, Sweet almonds
,, Turpentine	,, Alcohol
,, Carraway	

Although bromine and iodine exert on some of the essential oils chemically characteristic effects, it does not appear certain to what extent the action may be modified by the addition of small quantities of other oils; consequently the chemical phenomena, as well as a knowledge of their specific gravities, and boiling points, cannot be considered as offering any assistance to the detection of accidental or intentional impurities when existing in small quantities.

The process which I have to submit to you is one which has given great satisfaction in all the experiments which I have made, and was suggested by a discovery due to M. Rousseau, quoted by De la Rive,* "that olive oil when mixed with $\frac{1}{100}$th part its volume of oil of poppies, increased the number of vibrations of a magnetic needle in a given time, when the same was included or made to form part of a voltaic circuit." This isolated fact would be of service for the determination of the purity of olive oil, if oil of poppies were the only sophisticating ingredient.

I thought it useful to extend the observation to the effects produced by other oils when mixed with oil of olive, and to ascertain how far the process might be applied as a test for the commercial and chemical valuation of oils generally.

For this purpose I had first to measure the resistances offered by a column of each of the oils experimented on, having in each case the same length and sectional area.

From the low resistances possessed by the volatile oils, the apparatus used by M. Becquerel for ascertaining the resistances of liquids might be employed,‡ but from the high resistances offered by the fixed oils I have designed a modification.

I must here acknowledge the obligation I am under to W. Hooper, Esq., for the use of Sir William Thomson's delicate astatic reflecting galvanometers, and a battery which possesses remarkable constancy, viz., that of Daniell's as modified by Minotte.

With such a galvanometer as used for these tests, the deflections obtained are strictly proportional to the resistances, and by means of noting the deflection produced through a constant resistance, by a standard current, it is easy to compare the results obtained at different times and under different conditions. The standard current represents a known relation to the full electro-motive power employed.

The resistances of the essential oils were determined with one cell; and I may remark that I was considerably surprised at the low resistances of the volatile oils, this being the reverse of what, judging from the composition of them generally, I was prepared to expect.

The adulterants of the volatile oils are principally turpentine and alcohol.§

* "Treatise on Electricity" (translated by Walker).

† Since writing this I find the following note in "Paris's Pharmacologia" (1833), under the article "Olive Oil." "M. Rousseau has discovered the curious fact, that of all the oils, both vegetable and animal, olive oil most feebly conducts electricity. It may be stated that at a medium it acts 675 times more feebly than the others. Two drops of oil of beechmast, or of poppy seeds, poured into ten grammes of olive oil, renders the needle four times more sensible. This difference, therefore, furnished M. Rousseau, by means of his diagometer, a test for determining adulterations with precision."—(*Journal de Pharmacie*, t. ix. p. 587.)

‡ See "De la Rive's Treatise," vol. ii.

§ The foreign oils are no doubt sometimes entirely substituted for the English oils, or largely diluted with them.

Compared with any of the essential oils, turpentine has an immense resistance, whilst that of alcohol is enormously lower than any of them, except perhaps that of oil of bitter almonds, which is so low that I did not measure it.

The importance of this general fact is at once apparent, since the addition either of alcohol or turpentine in the smallest quantity is readily detected; and the quantity denoted by the variation in the deflection, either when compared with a standard of known purity, or by the resistances themselves.

The oils of lemon and bergamott, when mixed with a small proportion of turpentine, do not, however, show such marked differances as the generality of the essential oils. The addition of turpentine reduces the conducting power, or, in other words, increases the resistances to a very perceptible extent in all oils except lemon and bergamott, but in these two last cases it becomes, nevertheless, perceptible in the effects of increased resistance,—in these cases, however, a property not solely confined to turpentine aids in its detection, and consequently enlarges the scope of the application of this test. Large quantities of turpentine are instantly perceptible in increasing the resistances.

The addition of turpentine to oil of lavender is more strongly marked by this test than in any other case.

The following tables contain the averages of six tests on each oil, taken at different times. For reasons noted farther on, the same sample should not be used for a second test. The volatile oils were obtained from reliable sources, and were supplied as perfectly genuine and in mature condition. I am particularly indebted to Messrs. I. and H. Smith for the liberal manner in which they have supplied me with information respecting the samples obtained from them. I met with great difficulty in procuring samples of cotton seed oil, and although my samples are unauthenticated for condition or purity, I must acknowledge my obligation to Mr. Edward Mann, 7, Pall Mall East, for his kindness in procuring them.

TABLE OF RESISTANCES OF VOLATILE OILS.

Genuineness of Samples Authenticated.

Name of Oil.	Observed Deflection.	Ohmad's Resistance.
Peppermint, Ang.	224 × 8·94	800,000 *
,, ,, ...	274 × 8·94	652,160 †
Peppermint, German	236 × 8·94	759,000
Carraways	202 × 8·94	90,000
,, 2nd sample ..	202 × 8·94	90,000
Cloves	205 × 8·94	81,000
Bitter Almonds	—	— ‡
Aniseed	57 × 8·94	3',144,000
Bergamott	94 × 8·94	1,906,000 §
Lemon	53 × 8·94	3',376,000
Lavender, Ang.	310	5,244,000 ‖
,, Mitcham	250 × 8·94	717,000 ¶

* 1858 product. † 1861 product. ‡ Beyond range of observation. § Sample turbid. ‖ Deflection rising rapidly to 350. ¶ Deflection increasing slowly. This arises from electrolysis.

ADULTERATED SAMPLES.—VOLATILE OILS.

Name of Oil.	Adulterant.	Observed Deflection.	Ohmad's Resistance.
Peppermint, Ang.	Turpentine..	185 × 8·94	969,000*
,, ,,	Spirit of wine	43 × 8·94	422,000
Lemon	Turpentine..	52	3',444,000
Bergamott ..	Spirit of wine	157 × 8·94	11,600
,, ..	Turpentine..	92 × 8·94	1',949,000
Lavender, Ang.	,, ..	104	15',630,000

* Product of 1853.

The effects produced by mixing different specimens of the same oil together are also perceptible, thus the German oils of peppermint, or foreign samples of lavender oil produce modifications in the electrolysis.

In testing the fixed oils a much higher battery power is required; this arises simply from the fact that they all possess much lower conducting powers than any of the essential oils.

For these tests thirty-two cells were used.

TABLE OF RESISTANCES OF FIXED OILS.

Samples Purchased as Genuine.

Name of Oil.	Observed Deflection.	Ohmad's Resistance.
Olive	40 × 8·94	554', 637,600
,, ...	68	* 3,186',000,000
Sweet Almond	40 × 8·94	554', 637,600
,, ,, ...	35 ,, 8·94	†708', 048,000
Castor oil, Italian	91	2,242',152,000
Castor oil, E. I. Elect. ..	206 × 8·94	113', 287,680
Poppy..	326 ,, 8·94	68', 444,640
Turpentine..	340	590', 040,000
‡Cotton-seeds	220	§ 14',¶ 000,000
,, 2nd sample..	130	‖ 23', 500,000

* Bleached. † Bleached. ‡ Rising gradually to 300. § Sensibility of instrument increased. ¶ Rising rapidly beyond range.

From this table it will be seen that the bleached oils have even a lower conducting power than the unbleached oils; and in this respect olive oil possesses a greater difference than almond oil. It is not easy to explain this.

A singular difference exists between the Italian and the East Indian castor oils. This difference will enable one to detect a very small percentage of the one added to the other.

Cotton-seed oil and oil of poppy, as well as turpentine, are so rapidily altered in their conducting power by electrolysis, that there is not the slightest difficulty in recognising them in samples of oil.

Olive oil, when free from cotton-seed oil or oil of poppy, has its resistance increased by electrification, but if the smallest quantity of either of them exists in a sample of olive oil, it produces a contrary effect by a prolonged contact with the battery.

These results of electrolysis are alone important in determining the condition of a sample of olive oil.

I regret that I have not been able to extend these observations to commercial samples of olive oil of different qualities, and to have included a greater number of fixed oils, from the great difficulty of procuring specimens of reliability in purity or condition.

Liquid Carbonic Acid.—The well-known apparatus employed for so long a time by Mr. Robert Addams for liquefying carbonic acid, has been purchased by Mr. Stewart from funds supplied by the Royal Society, and Mr. Addams has kindly undertaken to make a preliminary experiment with his apparatus, as well as to give specific instructions regarding it. As the exact thermometric value of the freezing-point of mercury has been previously determined by Mr. Stewart, it is expected that the apparatus will furnish the means of verifying thermometers at very low temperatures.

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THE CHEMICAL NEWS.

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ON A METHOD OF RECOVERING SULPHUR AND OXIDE OF MANGANESE, AS PRACTISED AT DIEUZE, NEAR NANCY, IN FRANCE.*

By J. LOTHIAN BELL.

In the manufacture of soda, the use of sulphur plays an important part; the office it performs being to effect, in the form of sulphuric acid, the decomposition of common salt.

The sulphate of soda obtained from this action in its turn is subjected to decomposition by exposure to heat along with carbonate of lime and coal, a process which transfers, practically, almost the whole of the sulphur to the lime, or to the metallic base of this earth, the only exception being the small portion which remains with the soda as an impurity.

This new combination of sulphur is separated from the soda salts by lixiviation, and the portions undissolved, containing the sulphides of lime and calcium, and known as soda-waste, are thrown away.

I will not dwell on the inconvenience the soda-maker is exposed to from having to provide deposit-room for such a large quantity of refuse as the mode of treatment just mentioned gives rise to, nor on the somewhat offensive nature of the soda-waste itself, rendering the alkali manufacturer's heap any thing but a desirable neighbour.

Various are the plans which have been suggested for the recovery of this, the most costly element of the soda-maker's process, but hitherto, so far as actual practice is concerned, the whole of the sulphur employed by them may be said to be still thrown aside after it has once done the duty just alluded to.

Having heard a favourable account of a method in operation, at the Chemical works of the Dieuze Company, near Nancy, by the permission of the proprietors, I visited that establishment in the month of July last, and it is to give a brief account of their process that I now have to ask the attention of this Section.

It will be convenient at this stage of the description to remind you that in most soda-works there exists another residual product, scarcely less embarrassing in its nature than that previously mentioned. The muriatic acid obtained from decomposition of common salt with sulphuric acid, along with peroxide of manganese, is employed very extensively in the manufacture of bleaching powder, a process which gives rise to the generation of a large quantity of liquid chloride of manganese mixed with chloride of iron and free hydrochloric acid. The whole of these solutions are run away into the nearest water-course in the vicinity of the different manufactories.

The process I am about to describe requires the assistance of this second equally valueless material. The operation is as follows:—The soda-waste, after being removed from the vessels in which it has been separated from the soda, is thrown into a tank of stone-work about twenty yards long, by five in width, and six feet deep. In this vessel an intimate mixture is easily effected of the soda-waste and the metallic chlorides of the refuse from the bleaching powder process, and from which latter all the free muriatic acid has been removed in a manner to be hereafter described. Were the free acid still present, a loss of sulphur by the generation of sulphuretted hydrogen would take place, and this on all accounts it is obviously best to avoid.

A few hours suffice to convert the chlorides of manganese and of iron into sulphides, when the soluble chloride of calcium generated by the action is allowed to drain off. The solid matter remaining is cast out into a heap by the side of the tank containing it. In two or three days the heap is turned over, and in a short time a considerable elevation of temperature ensues, indicative of strong chemical action. To restrain this somewhat, the mass is kept moist, otherwise spontaneous combustion would ensue, sulphur would be wasted, and the desired results generally interfered with. During this stage of the process the metallic sulphides, under the joint action of the atmosphere and moisture, are peroxidized, and sulphur is separated. The oxides of manganese and iron so obtained are by subsequent turning over brought into contact with other portions of sulphide of calcium of the soda-waste, and are again converted into their respective sulphides, which give up their sulphur a second time in the way already described. The process is continued so long as there remains any sulphide of calcium from which it is sought to separate sulphur in the manner explained. The sulphur thus liberated is taken up by another portion of the sulphide of calcium of the soda-waste, and a polysulphide of calcium results from the combination, which is soluble in water. The formation of polysulphide continues as long as other portions of the original sulphide of calcium go on yielding up their sulphur to generate the sulphides of manganese and iron.† In this way almost the whole of the sulphide of calcium originally contained in the soda-waste is converted into polysulphide of calcium, hyposulphite and oxysulphide of lime, all of which are easily dissolved in water. Something like four or five days are required to effect these changes. These soluble salts are separated from the insoluble portions of the mass exactly in the same way as the ball alkali is treated for obtaining the soda it contains. Vats resembling in construction those of the soda works, and of a capacity equal to the daily production of soda-waste, are placed near the locality in which the preceding stage of the process has been effected, and in a very speedy manner the polysulphide and other salts are run off as a deep orange yellow solution, hereafter denominated the yellow liquor.

The composition of the insoluble portion is as follows:—

$CaOSO_3$	66·248
$CaOCO_2$	1·320
CaO	20·982
Fe_2O_3 and Al_2O_3	7·000
MnO	1·500
Insoluble	2·800
	99·850

As a refuse this substance will be recognised as being of an inoffensive character to the neighbourhood so far as any subsequent chemical action is concerned. Unlike the original soda waste it contains no ingredient liable to oxidation; it cannot therefore give off any of those unpleasant compounds which more or less are found in the vicinity of all alkali works. It is, moreover, not unreasonable to expect that a matter consisting chiefly of $CaOSO_3$ and CaO may be found useful as a stimulant to various descriptions of soils, and thus the whole of the S used in the soda process in one shape or another may be rendered useful instead of being a nuisance, as is the case at present.

The residual products from the bleaching powder works are received into a tank so built that free hydrochloric acid does not destroy the structure. By this means any

* Read before the British Association, in Section B.

† Along with this formation of polysulphide of calcium, there goes on at the same time a generation of hyposulphite and oxysulphides of lime due to the liberation of oxygen from the metallic oxides at the moment of being again converted in sulphides.

insoluble portions are separated, and the clear liquid is run off into an adjoining cistern.

To this acid solution of chloride of manganese and iron, is added that of the polysulphide of calcium and lime compounds of sulphur, obtained in the manner previously given. The presence of free hydrochloric acid causes an immediate precipitation of all the sulphur, free from the sulphide of calcium, and the accompanying substances containing sulphur; and the addition of the yellow liquor is continued until the first appearance of a black colour, indicative of all the free acid being neutralized, and the first portion of iron from the chlorine residuum commencing to be precipitated. The precipitated sulphur is removed from the liquid, and the greater portion of the accompanying water is separated by pressure. After this the remainder of the moisture is expelled by a very low heat, and the sulphur is then employed for producing sulphuric acid.

It is obvious from what has preceded that the chlorides of manganese and iron must be left in the solution from which the free hydrochloric acid has just been removed in precipitating the sulphur; and it is in this way that the neutral solutions of these metals are obtained which are required for operating upon subsequent portions of the soda-waste.

This process has been in operation at Dieuze for some months, and at the present moment by its means about one and a half tons of sulphur are being recovered daily. It will be seen that no new material is required, the only ingredients being the two waste products from the manufactory itself. The apparatus employed is of a most simple character, consisting almost entirely of tanks on which the expense for maintainance will be a mere trifle—in fact the whole cost is one of labour, which at the Dieuze works amounts to something like 40s. per ton on the sulphur obtained.

Supposing 40 per cent of the sulphur used in this kingdom to be thus recovered, the annual saving this process is capable of effecting will amount to a considerable sum.

Instead of employing the "yellow liquor" and the chloride of manganese in the way set forth in this paper, an attempt has been made at Dieuze to employ both as a means of recovering manganese, a desideratum with bleaching powder makers as eagerly sought for as the regeneration of sulphur has been with the soda manufacturer. I shall with your permission proceed to describe the process which the owners of the establishment assured me promises to be a success.

The acid solutions from the bleaching powder works, being all required in order to precipitate sulphur by means of the free hydrochloric acid, contain a considerable quantity of neutral chlorides of manganese, and will remain on hand. To such portions of these neutral chlorides as are not used in the sulphur process itself, yellow liquor is added in a suitable tank so long as a black precipitate falls, which is variable in quantity with the varying composition of the manganese used. The black precipitate consists of sulphide of iron and free sulphur, which can be collected and burnt in an ordinary furnace for burning pyrites.

The iron being thus all separated from the metallic solution, a fresh quantity of yellow liquor is added, by which all the manganese is thrown down, the precipitate consisting of some free sulphur and sulphide of manganese.

The sulphide of manganese is burnt in the same way as that of iron, but the residue, instead of being all oxide, as is the case when the sulphide of iron is under treatment, is composed of protoxide and binoxide of the metal mixed with a certain quantity of sulphate of manganese. The oxides are separated in the usual way by water, and being almost chemically pure, are of great value to the glass-makers, to whom the presence of the iron usually found associated with the manganese of commerce, is a subject of great inconvenience.

The sulphate of manganese as a concentrated solution is added to nitrate of soda in quantities denoted by the equivalents. When heated, decomposition takes place; nitrous acid is given off, which may be used in the sulphuric acid chambers, or otherwise disposed of; and the residue consists of sulphate of soda and the protoxide and binoxide of manganese, which latter represent, so far as available oxygen is concerned, a manganese amounting to 65 to 70 per cent of binoxide. The oxides of manganese are separated from the sulphate of soda in the usual way by washing with water, and both used for any purpose to which these two substances are commonly applied.

I may add that these operations have been carefully examined by some of the leading men of science of France, both in their practical and scientific relations, and that in the recent adjudication of prizes at the International Exhibition, at Paris, the inventors had a gold medal awarded for the service they are considered to have rendered to the industry of their country.

THE PHYSIOLOGICAL ACTION OF THE METHYL COMPOUNDS.*

By Dr. B. W. RICHARDSON, F.R.S.

THE author opened by briefly recapitulating the work of the previous reports, and by noting several facts showing in a satisfactory manner the practical good that had followed their publication. Passing to the methyl compounds, the substances now to be considered, he said they were of unusual interest, inasmuch as the poisonous gas known as fire-damp, and the beneficial agent chloroform, were included in the group. He then divided the substances to be described, in regard to their physiological action, into two distinct groups, with their chemical constitutions or characters—giving first in detail a list of the methyl series as follows:—

Methylic alcohol.	Bromide of methyl.
Hydride of methyl; marsh gas; fire-damp.	Acetate of methyl.
	Methylic ether.
Chloride of methyl.	Nitrite of methyl.
Iodide of methyl.	Nitrate of methyl.

The methylene series was given as follows:—

Chloroform (Terchloride). Tetrachloride of carbon.
Bichloride of methyl.

Dr. Richardson next discussed the action of the above substances in detail. The following is an abstract of his observations:—With regard to alcoholic fluids, he observed that the physiological law was that the period of time required by these bodies to produce their effects, and the period of time required for recovery, turned altogether on the boiling point of the fluid used. This was so certain that when the boiling point of one fluid and its action were known, the action of other fluids might be predicted from their boiling point. The explanation was simple. The alcohols taken into the body did not enter into any combination which changed their composition, but passed out of the body, chemically, as they entered it, and their evolution, and the time of their evolution, was the mere matter of so much expenditure of force, caloric, to raise them and carry them off. He had tested this, and found that intoxicated animals recovered more or less quickly according to the temperature in which they were placed—those in the higher degree returning the sooner to their normal condition. The practical lessons were, that in alcoholic poisoning of the human subject the most important condition for recovery

* Read in Section D, British Association.

was a high temperature; and that as methylic alcohol was more rapid in its action and much less prolonged in its effects than common alcohol, it could be used with great advantage by the physician in all cases where he felt an instant demand for alcohol. All alcoholic bodies are depressants, and although at first, by their calling injuriously into play the natural force, they seem to excite, and are therefore called stimulants, they themselves supply no force at any time, but take up force, by which means they lead to exhaustion and paralysis of power. In other words, the calorific force which should be expended on the nutrition and sensation of the body is expended on alcohol. Dr. Richardson added to his recommendation of methylic alcohol as a medicine the facts that when quite pure it was very palatable, and that it mixed easily with either hot or cold water.

The Hydride of Methyl.—The Hydride of Methyl occurs naturally in the form of fire-damp in mines, and as marsh gas on land. It is made artificially by heating together in a strong flask acetate of soda, caustic potash, and well dried lime. For physiological experiments the Hydride of Methyl can only be administered by inhalation. It is a pleasant gas to inhale, producing no irritation nor yet giving rise to any of those feelings of excitement which are induced by nitrous oxide gas or the vapour of chloroform. It might therefore be ranked, as Mr. Nunneley had long ago ranked it, as an anæsthetic; but, as its effect was evanescent, and the quantiity of gas required to produce an effect was very great, it was practically valueless for this purpose. Dr. Richardson then proceeded:—As this gas is often a cause of death in mines, I thought it was worth inquiry—What percentage of it would prove fatal in the air? I therefore had constructed a glass chamber, through which an atmosphere charged with various quantities of the gas could be passed. To my surprise, I found that even pigeons—animals peculiarly susceptible to the influence of narcotic gases—could live in an air charged with not less than thirty-five per cent of the gas, for the space of half an hour; while I could myself inhale the air coming from their chamber with the utmost ease. When at last by pushing the gas further, death is induced—it comes as a very gentle sleep, so gentle, indeed, that it is difficult to say when the action, either of the circulation or of the respiration, is over. The lungs are left with the blood in them, the heart has blood on both sides, and the blood itself retains its natural character. The death is by the slow negation of breathing. We may gather from these facts many important lessons in regard to the risks and dangers of miners from fire-damp. I should think it is almost impossible that any body of men, or any men who were awake in a mine, could be so entrapped with fire-damp only as to die in the absence of an explosion. In accidents where this seems to have occurred, I should imagine that with the fire-damp there is also evolved carbonic acid gas. I can, however, imagine after an explosion, when the mine becomes for a moment a great vacuum, that there would be sufficient entrance of the gas to produce a fatal atmosphere. In such case death would be prolonged, but as easy as sleep; two truths, which in cases of accident should inspire thankfulness and hope—thankfulness that those who thus die for us suffer little; hope as to the possibility of rescue, which should not for days be abandoned. The best direct means of recovery of those under the influence of fire-damp is exposure to heated air, and the administration of warm nurishing drinks, such as milk. Alcoholics do decided harm. From this point the author proceeded with a description of the action of chloride of methyl, the iodide, bromide, and acetate, methylic ether, nitrite of methyl, and the nitrate, over which we must pass, to record his more general researches on chloroform and its allies.

Methylene Compounds.—Dr. Richardson spoke at length on these compounds as anæsthetics, describing the nature and action of chloroform, tetrachloride of carbon, and bichloride of methylene (with which he put a pigeon to sleep under a glass shade). He had been led to the conviction that the cause of death from chloroform was in every case due to the arrest of nervous function, and that the idea of any direct action of the agent on the muscular structure of the heart was without foundation. He had conducted eighty-seven experiments specially to determine the direct influence of chloroform on the heart, and found in every case that organ capable of reaction on its exposure to air, while the lungs were always bloodless, white, and collapsed. The best means of restoration in impending death from chloroform was the introduction into the lungs, by artificial respiration, of air heated to 130° Fahrenheit. For doing so a small pair of handbellows connected with a thin tube of platinum in a coil was found to answer well, as with a spirit lamp the coil could be almost instantly made hot. It was only necessary to inject the air through one nostril. The tetrachloride of carbon had recently been brought into use as a substitute for chloroform. With regard to it Dr. Richardson said—As this substance is now gaining importance, I have thought it proper to subject it to very careful experiment, and I feel it my duty to state, both on theoretical and practical grounds, that it is far more dangerous than chloroform, and if it were as generally used it woul act fatally in a much larger number of cases. In its action it presents the same four stages as chloroform, but the second stage is more prolonged and intensified. In one animal, a rabbit, tetanic convulsion of an extreme character was presented during this stage. But the worst feature in the administration of this body is the slowness of its elimination—a slowness fully accounted for by the boiling point. Saturating the nervous centres, and expending their force to the fullest, it kills far more quickly and determinately than chloroform, and so completely is motion paralysed that the muscles scarcely respond to galvanism five minutes after dissolution. In order to make an exact comparison—and it is from this comparision I draw the results arrived at—I placed animals of the same kind, at the same time, at the same temperature, in chambers of the same size, and administered the same doses of chloroform and of the tetrachloride of carbon. Pigeons and rabbits alike gave evidence of the more severe effects of the latter substance. In this opinion my friend Dr. Sedgwick, who has rendered me valued aid in these inquiries, entirely coincides.

The Bichloride of Methylene.—The last compound on our list is of great interest, from the circumstance that it promises to be a new and valuable anæsthetic. In experimenting with chloride of methyl in ether, I was so struck with its good action that I asked Mr. Robbins, the chemist who had prepared the compounds for me, to endeavour to find, from the methyl bodies, a more stable compound, having similar physical properties. In a few days he brought me the fluid I now place before the Section, made for him by Dr. Versmann. This fluid is the bichloride of methylene. It is formed by the action of sulphuric acid on zinc in chloroform, and it differs from chloroform in that one atom of chlorine is replaced by an atom of hydrogen. Its boiling point is 88° Fahr., and the odour of its vapour is sweet, and much like that of chloroform. On testing it physiologically, I found it to be a gentle and perfect general anæsthetic. Under its influence animals lapse into the third stage of anæthesia with the slightest exhibition of the stage of excitements. The insensibility is deep and well sustained, and the recovery quiet and good. (Dr. Richardson here showed the experiment already mentioned of putting a pigeon to sleep.) In some experiments, in order to see the extreme effect, I have carried the administration to the extent of arresting the phenomena of life. I have thus learned that the respiration and circulation under the last action of this agent cease simultaneously, and that the muscles retain their irritability for even an hour after death. The lungs are left with blood in the respiratory circuit, both sides of the

heart are changed with blood, and the blood itself remains unaltered in physical property. Compared with other anæshetics, the bichloride of methylene appears to me to combine the anæsthetic power of chloroform with the safer properties of ether. It is too early to speak positively on this point, but if the expectation be fulfilled, the perfection of a general anæsthetic will have been obtained for the benefit of the world. And, even should this happy result not be accomplished, the way at least is paved towards the discovery of some intermediate body which shall answer to the required physical demand. In reviewing the facts connected with the physiological action of the methyl series, we gather that, according to their composition, they exert certain definite influences on different parts of the nervous organism. The oxide produces an influence specifically its own, that of slowly paralysing the motor function without destroying common sensibility. The nitrite and nitrate rapidly paralyse the centres of motion, while the chloride, and the iodide, together with the substitution chlorine compounds, not only paralyse motion but also destroy sensation. I conclude this report with one other observation. At first sight it may seem that the isolation of the phenomena produced by special agencies, and the discovery of a new anæsthetic, are sufficient characteristics of this research. With every respect, I submit that a broader question is involved. At the meeting at Birmingham I suggested, almost with a feeling of fear, that out of these studies might spring up a fixed principle of therapeutic discovery. Now, I have the conscious happiness of knowing that the hypothesis was correct. I feel convinced by this longer experience that by continued labour we shall be able to pronounce the precise physiological meaning and value of all the organic compounds, to extend the knowledge of curative action of these compounds to every condition of disease that is physically remediable, and to bring positive Science of Therapeutics to a position that shall stand out as a leading fact in the scientific advancement which the British Association so fervently encourages, and which at once solidifies and beautifies the progress of the present age.

BRITISH PHARMACEUTICAL CONFERENCE.

FOURTH ANNUAL MEETING AT DUNDEE.

President, PROFESSOR BENTLEY, F.L.S. M.R.C.S. &c.

THE President opened the proceedings on Tuesday Sept. 3 by delivering a most interesting address on "the study of botany in connection with pharmacy." Last year he gave an address on the same subject, when he confined himself to the consideration of some of the more immediate and direct advantages which the pharmaceutist, would derive from a knowledge of botany, while this year he spoke of its value, as a mental training, and as a recreation. Having alluded to the great advantages to be derived from the study of such branches of natural history as botany, in training the mind to observe correctly, discriminate accurately, and to acquire orderly and systematic habits, the president expresed an hope that it would not be long before such studies will become an essential part of the education of our youth. He then spoke of the advantage which the pharmaceutist would derive from taking up the study of a natural science by the combination of scientific with the more purely practical studies of their profession, thanking the liberal and enlightened founders and subsequent supporters of the Pharmaceutial Society for doing much to drive away the erroneous idea that a pharmaceutist should confine his attention entirely to the practical parts of his business. The president then proved the study of botany to be eminently calculated to prove an agreeable and healthful recreation to the pharmaceutist, urging upon the young student of pharmacy, the importance of its study during his pupilage in order that he may acquire that knowledge of its details and technicalites, as will enable him hereafter to pursue and enjoy it as a recreation, and concluded by thanking the local committee for the kind hospitable manner in which they received the visitors and for the very satisfactory arrangements they had made for holding the meetings of the conference.

We subjoin abstracts of the papers read during the sittings.

"*On the Adulteration of White Precipitate.*"

By J. B. BARNES, F.C.S.

Seventeen years ago I tested some white precipitate, in the stock of a highly respectable pharmaceutist, and found it contained 50 per cent of chalk, it had been supplied by a large wholesale house, at the price of a pure article.

I have received from members of the Conference, residing in the principal towns 58 samples, and three other specimens—small portions of each of these parcels were separately exposed to the action of a strong heat. Of this large number (61) four only exhibited evidence of the adulterant; from Bristol, I received four specimens, No. 1, was pure No. 2, contained 74·7 per cent of carbonate of lead, No. 3, contained 22 per cent of chalk, and No. 4, consisted entirely of carbonate of lead. From North Shields, three samples, one of them said to have been obtained by the retailer from Newcastle, and contained 94 per cent of chalk. One sample from Shrewsbury contained a trace of peroxide of iron, the remaining samples were all pure—I venture to think the result is very creditable to the members of our profession, the samples having been obtained in neighbourhoods where it might have been supposed that adulterated samples would be met with; indeed, my Bristol contributor states that he obtained his specimens from a locality where he was sure to be able to find adulterated drugs.

"*Notes on Effervescing Citrate of Magnesia.*"

By E. DYMOND, BIRMINGHAM.

The author protests against the pleasing deception which is practised in the sale of the various popular granulated effervescing compounds, being almost without exception known by names which do not express their composition and real character, and he holds that the welfare of true pharmacy is in jeopardy whilst we tacitly recognize such departure from correct chemical nomenclature, and from those obligations which we are under to the pure truths of science and morality. The writer placed upon the table a specimen of saccharated effervescing citrate of magnesia which fulfils the conditions required in this preparation of brisk effervesence during the discharge of carbonic acid, and a nearly bright subsequent solution.

"*Remarks on a Specimen of Seaweed Char.*"

By Ed. C. C. STANFORD, F.C.S.

Mr. Stanford introduced to the meeting an interesting specimen of charcoal, obtained by the carbonization of tangle. This substance consists of the long stems of *Laminaria digitata*, which are thrown up in great abundance on the western shores of the outer Hebrides; these are collected in the winter and dried in the air; these, when first thrown up, are long fleshy stems, 7 to 8 feet in length, and about the thickness of the wrist, but when dried, present hard, horny, flexible rods, about the size

of the finger. These, when carbonized, swell out into a highly porous charcoal, about three times their original volume.

The char contains about 40 per cent of salts free from sulphides and very rich in iodine.

After lixiviation the residual char has the following composition; it varies slightly, and the average proximate analysis in the dry state, is here given:—

Carbon	50
Phosph. lime	4
Carbonate of lime	20
Carbonate of magnesia	6
Silicic acid	5
Alumina	2
Sulphate of potash	5
Chlor. iodine.	5

and about 1·25 per cent ammonia.

It generally contains about 15 per cent of water, which it is very difficult to separate, the charcoal having a most powerful affinity for moisture.

Attention was called to the remarkable analogy between the chemical composition of this char and that of animal charcoal, which appeared to class it with that substance, and render it unlike any other char of a vegetable origin. This char cannot be used for sugar refining, on account of the large percentage of carbonate of lime; but it possesses decolorizing and deodorizing properties, superior, weight for weight, to the best animal char; tested with solution of caramel it decolorizes 25 per cent more than animal char under the same conditions.

It has been subjected to continued filtration of the thickest town sewage, for several months, without the least clogging, and its efficacy after this treatment remained unimpaired.

This communication was merely preliminary, the author promising the results of further investigation on this and other specimens of seaweed char.

The tangle char was bought before the meeting as a cheap and efficient substitute for animal char in its application other than that of sugar refining; and its introduction excited an interesting discussion.

"*On Glycelæum, a Proposed basis for Ointments.*"

By T. B. GROVES, F.C.S.

Take of

Almond meal	½ oz.
Glycerine	1 ,,
Olive oil	3 ,,

Mix s. a. It may be effected in a mortar in the ordinary way, up to nearly the end of the operation; but it is better, I think, to use the spatula and "slice" in the last addition of oil. It will then form a soft, semi-gelatinous paste, which, when mixed gradually with water or a watery fluid, forms readily an emulsion. The glycerine it contains being protected by the oil it does not quickly deliquesce, though when exposed to the air for some time it does often somewhat. It is of course unaffected by the ordinary temperatures of the body; if it were otherwise, its softness would be an objection to its use; as it is, it leaves plenty of room for powdery admixtures of every kind.

It is only essential to remember that the body in the first place must not precipitate emulsine, in the second place must be a fluid. I have in several ways attempted to emulse lard. I have melted it and succeeded perfectly, so long as it remained fluid; but if stirred after solidification, the emulsion was at once "inverted," or as Mr. Proctor styles it, converted into a "negative" emulsion, *i.e.* the glycerine is emulsed in the fat, and no the fat in the glycerine. t

The advantages I attribute to glycelæum as compared with ointments and with plasma, I imagine to be these:—Ointments are greasy, prone to rancidity, do not "touch" in a strict sense, watery surfaces, and are not easily removed from the surfaces to which they become attached; on the other hand they are cheap, they are fatty, and they are repellent of moisture.

Glycelæum has been little tried as a remedy; I have had difficulty in finding persons to make a trial of it. Dr. Tilbury Fox has, however, at Mr. D. Hanbury's suggestion, made some experiments with it, and reports "that he likes it very much; that it is a capital thing where it is a desideratum to get hardened parts into a more 'supple' condition." Although I can bring but one testimony in its favour, it must be allowed to be a first-rate one.

Still less trial has been made of glycelæum as a vehicle for the administration of oils and balsams, though it would not be difficult to find stomachs that support with difficulty castor and cod-liver oils, and balsam of copaibæ. As "oiled" melted butter is known to upset a weak stomach, whilst well-made, *i.e.* well-emulsed melted butter does not, it might be inferred that an emulsed oil would in some cases agree with the stomach when the plain oil would not. I am convinced of this, that the glycelæum copaibæ, stiffened with powdered cubeb, would form a more elegant and a more supportable electuary than the nasty and imperfectly mixed mass one commonly meets with.

I have already alluded to the fact, that it is to the emulsine contained in the oil-seed we must attribute the extraordinary emulsive power of these vegetable powders. (Certainly no organic principle has been more consistently named than it.) This I have proved experimentally, by preparing some of the substance, and trying it in its purs state. I found that five grains dissolved in one drachm of water would emulse into a jelly four drachms ol olive oil (using the spatula, not the pestle). I prepared the emulsine by digesting for a few hours powdered almond meal with tepid water filtered, and added to three measures of the filterate five measures of rectified spirit, collected the precipitate and dried it at a temperature not exceeding 100.°

ON A REAL IMAGE STEREOSCOPE.*

By J. CLARK MAXWELL, F.R.S.

In all stereoscopes there is an optical arrangement by which the right eye sees an image of one picture, and the left eye that of another. These images ought to be apparently in the same place and at the distance of most distinct vision. In ordinary stereoscopes these images are virtual, and the observer has to place his eyes near two apertures, and he sees the united images, as it were, behind the optical aparatus.

In the stereoscope which I have had made by Messrs. Elliott Brothers the observer stands at a short distance from the apparatus, and looks with both eyes at a large lens, and the image appears a real object close to the lens.

The stereoscope consists of a board about two feet long, on which is placed—1. A vertical frame to hold the pair of pictures, which may be an ordinary stereoscopic slide turned upside down. 2. A sliding piece near the middle of the board, containing two lenses of six feet in length, placed side by side, with their centres about one inch and a quarter apart. 3. A frame containing a large lens of about eight inches focal length and three inches diameter.

The observer stands with his eyes abont 2 feet from the large lens. With his right eye he sees the real image of the left-hand picture formed by the left-hand lens in the air close to the large lens; and with the left eye he sees the real image of the other picture formed by the other lens in the same place. The united images look like a real object in the air close to the larger lens. This image may be magnified or diminished at pleasure, by sliding the piece containing the two lenses nearer to or farther from the picture.

* Read before the British Association, in Section A.

ON THE ANALYSIS OF CAST-IRON.

By EDMUND G. TOSH, Ph.D.

(Continued from page 95.)

Estimation of Graphite. 2 to 3 grammes of iron were treated with dilute hydrochloric acid, and when solution approached completion a considerable quantity of strong acid was added to separate the last portions of iron and manganese. The insoluble matter, consisting mostly of graphite, was collected on a carefully weighed filter, washed with hot water, dilute hydrochloric acid, solution of caustic soda, and hot water again, successively, lastly with alcohol and ether to remove oily hydrocarbons as recommended by Max Buchner.* By washing with dilute acid and with alkali, iron and silica or oxide of silicium were separated. After drying at 120° C. the filter and graphite are weighed, and burned away. The small residue (a mere trace of silica or titanic acid) is weighed, and this weight subtracted from the first gives the amount of graphite. The results obtained agree very closely, as shown in the two following cases:—

1 2·36725 grms. iron gave 0·08375 grm. insoluble matter, containing 0.013 grm. incombustible residue. Graphite per cent =2·978.

2. 2·991 grms. iron gave 0·1095 grm. insoluble matter containing 0·01725 grm. incombustible residue. Graphite per cent =3·0842.

In washing the graphite with solution of soda, there was always a brisk effervescence, due according to Schafhäutl † to the oxidation of oxide of silicium to silicic acid, by decomposition of water, with consequent liberation of hydrogen.

The difference between the quantities of graphite and of total carbon, is the amount of carbon in the combined state.

Estimation of Silicium. About 2 grammes of the iron were dissolved in aqua regia, and evaporated to dryness. The insoluble matter was collected, washed, dried, ignited and cautiously deflagrated with nitrate of potash. Graphite is thus quickly burned away: the fused mass is extracted from the crucible by means of water. The alkaline silicates in solution are decomposed by hydrochloric acid in considerable excess, and the whole evaporated to dryness. To the dried mass a few drops of hydrochloric acid are added, and afterwards water. The insoluble silica is filtered off, washed, dried and ignited till quite white. From its weight the proportion of silicium in the iron may be deduced.

Estimation of Sulphur. About 3 grammes of the iron were dissolved in nitric acid, with the occasional addition of a few drops of hydrochloric acid, and evaporated to dryness. The residue is dissolved in the least possible quantity of hydrochloric acid, and water added. The sulphuric acid in the clear, filtered solution is precipitated by chloride of barium. After standing 24 hours, the sulphate of baryta is collected. It is generally contaminated with a little iron which may be removed by treatment with dilute hydrochloric acid.

Estimation of Phosphorus. 3 grammes of the iron are dissolved in aqua regia, the solution evaporated to dryness, and the insoluble matter filtered off. The perchloride of iron solution is reduced to the state of protochloride, by heating with sulphite of soda. Although perfectly reduced, the solution still retains a yellow colour due to dissolved organic matter. All excess of sulphurous acid is boiled off, a little perchloride of iron is added, and the solution cautiously neutralised by means of carbonate of soda or ammonia, till the precipitate formed does not dissolve again. This small portion of peroxide of iron containing all the phosphoric acid, is filtered off, washed, redissolved in a little hydrochloric acid, and the phosphoric acid precipitated as ammoniophosphate of magnesia, the iron being held up in the ammoniacal solution by citric acid.

Estimation of Manganese. 3 to 4 grammes of iron are dissolved in aqua regia; the solution is largely diluted and filtered, and neutralised with carbonate of soda or ammonia till of a deep brown colour. The iron is precipitated by acetate of soda, and the solution immediately boiled. The large precipitate settles quickly, the clear liquid is poured off and filtered. After three washings by subsidence and decantation, the precipitate is thrown on a large filter and again washed. The bulky solution containing all the manganese is evaporated to small volume and refiltered. The manganese is first precipitated by sulphide of ammonium, the sulphide collected and washed with sulphide of ammonium water, redissolved in hydrochloric acid, the solution boiled, and the manganese reprecipitated as carbonate by carbonate of soda, filtered off, washed, dried and ignited till of constant weight, showing its perfect conversion into Mn_3O_4.

Titanium. The estimation of this element in any substance is somewhat uncertain, and its determination in pig iron can scarcely be accurately accomplished. Its detection in iron is not difficult. A considerable quantity (5 grms,) of the specimen is treated with dilute hydrochloric acid, and insoluble collected, graphite burned off, and the residue freed from silica without loss of titanic acid, by heating with a mixture of hydrofluoric and sulphuric acids as recommended by Riley.* After driving off sulphuric acid, titanic acid is left behind, which may be distinguished by the violet reaction it gives with microcosmic salt and a little tin in the reducing flame of the blowpipe.

It may be approximately estimated in the following way. About 6 grammes of iron are dissolved in hydrochloric acid, and the whole evaporated to dryness. The dried mass is moistened with hydrochloric acid, water added and the solution filtered. Part of the titanium exists in the solution (a) and part in the insoluble (b). The solution, if containing much perchloride of iron, is reduced by sulphite of soda, the excess of sulphurous acid boiled off, a little perchloride of iron added, and the titanic acid precipitated in combination with the sesquioxide of iron thus introduced, by means of carbonate of soda, as in the estimation of phosphorus. The small precipitate is quickly filtered off. washed, dried, ignited and carefully set aside.

From the insoluble matter (b) graphite is burned off, and the silica is removed by hydrofluoric acid in the presence of sulphuric acid. To the residue after this treatment the small ferruginous precipitate from (a) is added, and the whole fused with bisulphate of potash. When cool the fused mass is extracted with cold water, and from the clear filtered solution, titanic acid and iron are precipitated by ammonia; the precipitate is slightly washed, and sulphide of ammonium added. The sulphide of iron thus formed is dissolved by sulphurous acid, while the titanic acid mixed with sulphur is undissolved, and may be collected, ignited and weighed, after which it should be tested as to its purity.

Nitrogen was estimated by the following process of Boussingault.† 5 grammes of the iron under examination are slowly dissolved in very dilute hydrochloric acid. By this means a part of the nitrogen is converted into ammonia, and exists in the solution as chloride of ammonium, and another portion remains in the insoluble, probably combined with the titanium. This insoluble is collected, and the filtered solution is treated in a capacious flash with a considerable excess of caustic lime and boiled. A tube connected with the flask by a tight cork, dips into dilute hydrochloric acid, by which the liberated ammonia is absorbed. Nitrogen is estimated in the graphitic matter insoluble in acid by burning with soda-

* Journ. f. prakt. Chem. Bd. 72. p. 364.
† Journ. f. prakt. Chem. lxvii. p. 257.

* Journ. Chem. Soc. Vol. p. 311.
† Comptes Rendus. T. lii. p. 1088.

lime, the ammonia formed being also absorbed by dilute hydrochloric acid. Both solutions are now brought together, evaporated to small bulk, chloride of platinum added, the small precipitate collected, washed with alcohol, dried, ignited, and the remaining platinum weighed, from which the amount of nitrogen may be calculated.

Nickel, cobalt, and copper were carefully sought for by operating on large quantities of the various specimens of iron, but evidence of their presence could not be obtained. 63 grammes of iron were deflagrated with a mixture of carbonate of soda and nitrate of potash, the contents of the crucible dissolved out with hot watsr, and the highly alkaline solution filtered off from the large quantity of sesquioxide of iron. This solution was first neutralised with hydrochloric acid, chloride of ammonium, ammonia, and sulphate of magnesia added, and any phosphoric and arsenic acids allowed to precipitate during 24 hours. The precipitate was collected, washed with ammonia water, dissolved in acid, the solution heated and sulphuretted hydrogen passed through it. A very small light yellow precipitate formed, which proved to be sulphide of arsenic.

In all determinations of iron, where practicable, I have used the volumetric method by means of bichromate of potash, first proposed by my former professor Dr. Penny, of Glasgow, which is I think preferable to that of Margueritte, where permanganate of potash is employed. Bichromate is much more stable than permanganate, and the strength of the solution only requires to be determined once. Besides, in the estimation of iron by Penny's method, there is no fear of the evolution of chlorine, which has to be so carefully guarded against in Margueritte's process.

THE ELECTRIC INDUCTION OF MR. HOOPER'S INSULATED WIRES, COMPARED WITH GUTTA-PERCHA INSULATED WIRES, FOR TELEGRAPH CABLES.*

By WILLIAM HOOPER.

The author referred to the relation existing between the different properties of insulated wires arising from induction. He showed by an extensive series of experiments that an intimate connection exists between the effects of electrification and electrostatic induction, and that the penetration of electricity into the substance of an insulator, when measured by the residual discharge, is a function of the electro-static capacity, and not simply of resistance. He has also shewn that the effects of electrification are increased nearly in the same proportion as the interior inductive action is reduced.

The results render it extremely probable that in rapid signalling through long circuits, as by "waves," the rate of transmission attainable is not increased or diminished in the simple proportion of the electro-static capacities, but in a ratio compounded of it and the interior resistance to inductive action.

This is a matter of serious consideration, for the interior induction, unlike the surface induction, is not reduced by an increased thickness of insulator, which points strongly to the practical advantage derivable from Mr. Hooper's dielectric over gutta-percha in every respect for induction. These results are verified by Mr. Latimer Clark, Mr. Varley, Professor Sir W. Thomson, and Mr. Fleeming Jenkin.

So much superior is Hooper's dielectric to gutta-percha for insulation, that, taking the core of the electric telegraph cable connecting Ceylon with India as an illustration, at 75° Fahrenheit, the temperature at which cores are tested, it would require a core nearly 2 feet diameter of gutta-percha to equal ·38 inch diameter of Mr. Hooper's insulator (that is, 200 lbs. of Hooper's insulator is equal to 576,000 lbs. of gutta-percha), the same conductor being used in each, to obtain the same degrees of insulation.

* Read before the British Association, in Section A.

ANTISEPTIC PROPERTIES OF THE SULPHITES.*

Dr. RICHARDSON read a paper by Dr. Polli, in Section D, "On the Antiseptic Properties of the Sulphites." He stated that he was afraid he might not make a good representative of his learned friend, Dr. Polli of Milan. However, as he had long communicated with Dr. Polli on the subject, and knew well what that gentleman meant, he (Dr. Richardson) had chosen, instead of trying to present the paper as a whole, rather to give the facts presented by him as the results of extended observations. Sulphurous acid was said to be the most active agent in preventing or arresting all organic fermentation. As the acid, however, was not sufficiently applicable in experiment, Dr. Polli had undertaken an investigation as to the action of the sulphites of lime, hyposulphite of magnesia, sulphite of magnesia, sulphite of soda, and granulated sulphite. These substances were found to possess all the properties of sulphurous acid, with the advantage that their action was more uniform and certain and constant. In experimenting on animals and himself, he found that large doses could be taken without risk. On killing animals treated with sulphites, and others not so treated, he found that the former were most slow to decompose, and, indeed, remained quite fresh when the others were putrescent and offensive. Another series of experiments showed that in one class the administration of the sulphites was sufficient to effect a more or less rapid cure in cases where blood-poisoning was present, as in fevers. Dr. Richardson distinctly mentioned, however, that Dr. Polli was anxious to have it clearly stated that he did not attribute this to any curative power in the sulphites, but to the fact that they arrested decomposition, and by so doing allowed the animal to recover by the recuperative power existing in its own constitution. The author thought his observations conclusive as to the excellent influence of the sulphites on the septic diseases, and remarked that it was for the purpose of thus benefiting others that he had brought his researches under the attention of the scientific world. Dr. Richardson laid some of the sulphites before the Department, and mentioned that he would be glad to let physiologists have four or five ounces of any of them for the purpose of experimenting. and that physicians might also receive a small quantity for hospital practice.

* Read before the British Association.

Iodine soluble in certain Organic Compounds.—Hlasiwetz. Iodine dissolves to a considerable extent in aqueous solutions of resorein, orein, or phloroglucin, without imparting to them any colour. These solutions may be boiled without iodine being volatilised; they have almost neutral reaction, and starch, or carbonic bisulphide does not indicate free iodine. A solution of the latter in alcohol or carbonic bisulphide is decolorised by adding one of the organic bodies mentioned, which may therefore be used in place of sulphurous acid in volumetric determinations by means of iodine. Other organic substances have been observed to behave in a similar, but less decided manner.—(*Akad. Wien*, 231, 1867.)

ON A NEW FORM OF DYNAMO-MAGNETIC MACHINE.*

By W. LADD.

It is now thirty-six years since Faraday first published his celebrated "Researches in Electricity and Magnetism;" the foundation then laid has been receiving additional strength as the superstructure has progressed. Faraday has gone to his rest, bnt the name he always tried to hide behind his philosophy will shine brighter and brighter, until the top stone is raised in future ages. The machine I am about to describe is a part of that superstructure. The repeated application to me for a machine that would give a sufficient light for the purposes of lecture demonstration and would dispense with the galvanic battery, has induced me to give considerable attention to the subject, and I must leave you to judge how far this machine meets, not only that requirement, but also that of lighthouse illumination.

Perhaps the most powerful magneto-electric machine was that constructed by Mr. Wilde, the electro-magnet receiving its charge from sixteen permanent steel magnets, but Siemens and Wheatstone have shown that the residual magnetism left in soft iron. after being under the influence of a battery, or permanent steel magnets, can be augmented from the currents generated by itself, by merely applying dynamic force to the revolving armature, containing a coil of copper wire, the terminals of which are connected with the wire surrounding the electro-magnet; and although great effects were produced *in* the electro-magnet, the current itself could only be made available by its partial or total disruption—in the former case diminishing the power of the electro-magnet, and in the latter reducing it to its normal condition. But in the machine I have constructed, the power of the electro-magnet is kept up, whilst a separate current, to be applied to any useful purpose, can be drawn off by means of an independent arrangement.

It consists chiefly of two plates of iron; to both ends of each plate is fixed a portion of a hollow cylinder; these plates are then placed a certain distance apart, and insulated from each other in such a manner that the cylindrical pieces will form two hollow circular passages; into these spaces two armatures (known as Siemen's armatures) are placed. The plates are surrounded by a quantity of stout copper wire, connected together, the two terminals of which are brought into connection with the commutator of the smaller armature, so that each change of polarity in the armature will augment the magnetism. When the machine is first made it is only requisite to pass a current from a small cell of Smee's or any other element, for an instant, to give the iron a polarity; it will then retain a sufficient amount of magnetism for all future work.

If the armature in connection with the electro-magnet is made to rotate, there will be a very feeble current generated in it; this passing round the electro-magnet, will increase its power with every additional impulse. It will thus be seen that the only limit to the power of the machine is the rapidity with which the armature is made to rotate, which is entirely dependent on the amount of dynamic force employed. But the great improvement in this machine is the introduction of the second armature, which, although it takes off very powerful currents, generated in its wire by the increased magnetism, does not at all interfere with the primary current of the electro-magnet.

The machine now at the Paris Exhibition measures about 24 in. in length, 12 in. in width, and stands 7 in. high; but this being imperfectly constructed as to its proportions, the results obtained are, no doubt, much less than they would be with a properly constructed machine. Still, I found it would keep 50 in. of platinum wire, ·10 in. diameter, incandescent, and when a small voltameter was placed in circuit with the second armature it would give off 250 cubic centimetres of gas per minute, and in connection with an electric regulator would give a light equal to about thirty-five Grove's or Bunsen's elements, the driving power expended being less than one horse.

I have now to describe a machine on the same principle as that just noticed, but which, instead of having two independent armatures running in separate grooves, has two armatures fixed end to end, so as to appear like one continuous armature, but so placed with reference to each other that their magnetic axes shall be at right angles. By this arrangement there is only one opening required for the armature, enabling us to take full advantage of the horse-shoe form of electro-magnet. The shoes of the electro-magnet and armatures are so proportioned to each other that there is an actual break in the magnetic circuit with reference to each armature alterately, but by their disposition at right angles there never is an actual break in the complete magnetic circuit, but simply a shifting of the principal portion of the magnetic force from one armature to the other at the precise moment required to produce the best effect. The mechanical advantages obtained by this disposition of parts must be at once obvious, as one pair of bearings and set of driving gear is dispensed with, and from the fixing of the two armatures together the currents are made to flow perfectly isochronously. It may be found of advantage to vary the angle of position of the armatures with reference to each other, according to the speed at which they are driven, so that the current given off by the exciting armature may at the precise moment exert its full effect upon the electro-magnet, and thus produce the best effect in the second armature.

* Read before the British Association, in Section A.

ON THE COMMERCIAL ANALYSIS OF SOME OF THE PRODUCTS AND MATERIALS OF THE ALKALI MANUFACTURE, &c.

By C. R. A. WRIGHT, B.Sc., F.C.S.

[Continued from page 152.]

III. **Soda Ash.**—The commerical valuation of soda-ash is usually restricted to the determination of the percentage of "available alkali" contained therein, by this term being meant the total Na_2O contained in a state capable of saturating a strong acid, as sulphuric; and hence including hydrate, carbonate, aluminate, silicate, sulphide, sulphite, and hyposulphite. The analysis is usually performed by adding the standard acid to the hot aqueous solution of a known weight of ash until a slight acid reaction is obtained; by this means all calcium contained, and the Al_2O_3 contained as aluminate, are estimated as though they were soda. Practically this error is of slight importance; it may be readily avoided by addition of a very slight excess of acid along with some litmus tincture then adding a slight excess of standard sodium carbonate solution, boiling and filtering from the precipitated lake and $CaCO_3$: the excess of soda added is now again determined by the standard acid, and thus the exact amount of acid used to saturate the Na_2O present in the "available" state is known. An abuse, however, that has long been practised in the soda trade in connection with this is the following:—The equivalent of sodium is considered to be 24 (instead of 23·04—Stas). Hence by varying the mode of calculation, a varying error is introduced, the available alkali being always represented as more than it really is. If sodium be thus calculated, the error is $+\frac{0·96}{24}$ or 4·0 parts in 100: if

Na_2O be calculated, the error is $\frac{64-62{\cdot}08}{64}$ or 3·0 parts in 100; while if Na_2CO_3 be calculated, it is $\frac{108-106{\cdot}08}{108}$ or 1·8 parts in 100. Hence according to the plan employed in determining the standard of the acid used, according as soda salts are thus used, or other substances, an error of from 0·9 to 2·0 per cent is introduced in the valuation of a 50 per cent ash. Hence arises the custom in many alkali works of invoicing the sales of ash at from 1 to 2 per cents higher than their real strength, it being known that the purchaser will accept the analytical certificate calculated on this erroneous basis. This practice, which is neither more nor less than a barefaced fraud, is by no means universal, nor is it known to many of the purchasers of soda ash; in certain districts, however, it prevails, and is a constant source of vexatious complaint whenever the purchaser happens to employ on his own side a more conscientious analyst. The writer has known soda ash of identical quality invoiced part to one customer as containing 48 per cent, part to another as 49 per cent, and part to a third as 50 per cent, the actual percentage being 48½; the separate consignments being reported also in these different strengths by the analysts in the different towns to which the goods were sent: inasmuch as soda ash is usually valued as so much per cent per cwt,—this amounts to a direct fraud on the purchaser. It sometimes happens that an analyst, known to object to this system, finds that his connection for the analysis of soda ash becomes *nil*, being transferred to some less scrupulous rival.

When the exact composition of a sample of soda ash is required, the following method may be adopted.

(*a*). A known weight is heated to 150°—200°C., and the loss of weight considered to be moisture.

(*b*.) The residue of (*a*) treated with hydrochloric acid leaves sand and insoluble matters, and in the filtrate the SO_4 may be estimated volumetrically, or better gravimetrically, by barium chloride.

(*c*). The CO_3 present is estimated in Mohr's apparatus, or in Fresenius' and Wills', with the addition of some potassium chromate.

(*d*). A known weight is treated with water, and the solution evaporated to dryness with hydrochloric acid; thus the SiO_3 is determined; the filtrate from this with ammonia throw down alumina, from which the Al_2O_4 (as aluminate) is known.

(*e*.) The insoluble residue of (*d*) with hydrochloric acid and ammonia, gives the Fe_2O_3 and Al_2O_3 (not as aluminate), the filtrate from this with ammonium oxalate gives the calcium (usually only traces).

(*f*). A known weight is dissolved in nitric acid, and the Cl estimated by a standard silver solution.

(*g*). A known weight dissolved in water is oxidized by chlorine, and the sulphate thus formed determined; a known weight is dissolved in water, and the solution divided into two equal parts; in one the iodine required to yield a blue colour when starch and acetic acid are added, is determined, to the other zinc sulphate is added, and in the filtrate the iodine required after removal of sulphide is again determined; from these data the sulphide, sulphite, and hyposulphite are calculable.

(*h*). The total "available alkali" is determined, the error due to the alumina of the aluminate being eliminated as previously mentioned; subtracting from this calculated as sodium, the sodium corresponding to the SiO_3,Al_2O_4, sulphide, sulphite, hyposulphite, and CO_3 found, the difference is calculated as hydrate; this may be checked by adding barium chloride to a known weight, and determining the amount of acid required to neutralize the filtrate: rather more hydrate is usually indicated by this mode than that really present owing to the presence of a portion of aluminate, hyposulphite, &c., incompletely thrown down by the barium salt.

Carefully executed analyses according to this method have yielded the writer results adding up to 99·8—100·1.

When ferrocyanide is present, it may be estimated by dissolving a known weight of ash in hydrochloric acid, and adding ferric chloride; after standing some time, the precipitated Prussian blue may be well washed, treated with pure potash, and the ferrocyanide determined in the solution by permanganate.

(IV.) Bleaching Powder.—The commercial estimation of bleaching powder only extends to the estimation of the hypochlorite contained therein; the result being, however, calculated as so much per cent of "available chlorine." Of the numerous methods proposed for the determination of the hypochlorite, the one usually employed in the trade is that depending on the amount of ferrous salt oxidized by a given weight of bleaching powder. It frequently happens, however, that instead of a perfectly pure ferrous salt (such as the ammonio-sulphate $FeSO_4+(NH_4)_2SO_4+6H_2O$ precipitated by alcohol), the ordinary "protosulphate of iron" of the druggists is used, discoloured crystals being of course rejected; rarely does this substance contain 100 per cent of the compound $FeSO_4+7H_2O$, and hence errors frequently are introduced, less chlorine being required to peroxidise a given weight of impure than of pure substance. Again, some analysts neglect to add an acid to the ferrous solution used, and hence the precipitated ferric hydrate is liable to carry down perceptible quantities of ferrous hydrate, again making the apparent amount of chlorine required less than that really requisite. When acid is added, an error is liable to be introduced by the peroxidation of part of the iron by chlorine compounds derived from chlorate that may be present; direct experiments have shown the writer that acid ferrous solutions are perceptibly oxidized by the presence of chlorate in small quantities in the course of a very few minutes, even at the ordinary temperature, although the peroxidation due to the whole of the chlorate is not manifest until after standing some time at 20°C., or, till after heating to ebullition. Lastly, the equivalent of chlorine is frequently taken to be 36 instead of 35·46 (Stas). All these sources of error tend to make the percentage of chlorine found higher than that really present; accordingly it frequently happens that analyses of the same sample by different analysts differ by 1, 2, or 3 per cents of available chlorine; this error becomes of serious importance, it frequently happening that the analysts employed by the seller and purchaser differ in their reports, thus causing much annoyance, and possibly the rejection of the goods as not being of contract strength.

As regards the error introduced by the presence of chlorate in the sample analysed, many careful experiments on the subject have yielded the following results to the writer:—

1. Acid ferrous solutions are peroxidised by addition of a chlorate, at a rate depending on the strength of the solutions, the amount of free acid, and the temperature, the reaction taking place completely after heating to ebullition for a minute, and almost as completely after standing for upwards of half an hour at 20°C., time being, however, required for any temperature short of ebullition.

2. Acid solutions of As_2O_3, where a large excess of free acid is present, are scarcely affected by chlorate at 20°C., until after standing some hours; the reaction ensues completely on heating to ebullition for a minute, and completely in a few minutes' heating on a water bath.

3. Alkaline solutions of As_2O_3 (containing $NaHCO_3$ and free carbonic acid) are wholly unaffected by chlorate, either cold or boiling, even after several hours.

4. Acid solutions of potassium iodide (free from iodate). Iodine begins to separate even at 20°C. in a very few moments on addition of very little chlorate, and after some time much separates. Heated to 100° on the water bath, the whole of the chlorate becomes completely decomposed, after five minutes, in presence of sufficient free acid.

5. Alkaline solutions of potassium iodide are unaffected by chlorates even on long standing or long boiling.

CORRESPONDENCE.

THE ALKALI TRADE.

To the Editor of the Chemical News.

Sir,—By the aid of your valuable paper, I would be glad to ask your readers if any of them could advise me in a few law and other points connected with the alkali trade. I am the manager of works which are situated in a village, and though I know no preventable gas escapes, and the inspector gives us credit for a very complete condensation of muriatic gas at the condensers, still I am constantly annoyed by receiving complaints from persons living, or having works in the vicinity of ours. We have, like all other alkali and bleaching powder works, to cause a trifling unpleasantness for a short time, when running off our stills, but unlike many others we are situated in a populated neighbourhood, and still more unfortunately the still-house is placed next our neighbour's wall. I keep the nuisance at a minimum, but still I hear reports of action which make me desire to know (if any of your readers can kindly inform me), whether there is any law about a case of this description, where the gas causing the nuisance is not muriatic acid, and therefore does not come under the supervision of the government inspector. I would also like to know whether the inspector have any control over the muriatic gas that escapes from the furnaces, because it is well known that a close or "blind" furnace does not throw off its gas so well as an open one, consequently with a "blind" furnace there is a great deal more comes off a batch of "sulphides" when being drawn.—I am, &c.

"Nuisance."

SPECIFIC GRAVITY PROBLEM.

To the Editor of the Chemical News.

Sir,—The following solution of the Specific Gravity Problem, proposed by your correspondent Henri du Chemin-creux, may satisfy him, although I do not bring it forward with the idea that there may not be a shorter way of solving it.

The question may be summarised thus:—

To 1,000 grains of liquid of Sp. Gr. 1·314

x " " " 1·000 are added

giving $1{,}000+x$ " " " 1·286

Find x.

Now, the relation which subsists between these two groups of quantities is, that the sum of the products of the number of grains of the two liquids taken separately into their respective specific gravities is equal to the product of the number of grains of the two liquids taken together into the specific gravity of the mixture thus obtained. We have then—

$$1{,}000 \times 1{\cdot}314 + x \times 1{\cdot}000 = (1{,}000+x)1{\cdot}286.$$

Simplifying this equation, we obtain—

$$0{\cdot}286\,x = 28$$

From which $x = \frac{28}{0{\cdot}286} = 97{\cdot}9$ grs. the quantity required

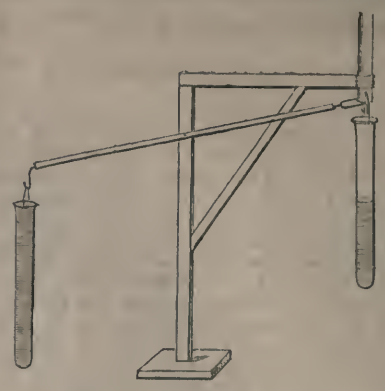
In conclusion, I may state that I tried this process with a solution of common salt, and arrived at a satisfactory result.

F. J. R. C.

HYDROSTATIC PARADOX.

To the Editor of the Chemical News.

Sir,—The following simple experiment will illustrate the important principle of hydrostatic pressure; and I therefore take the liberty of sending it for the amusement of your readers.



Let two test-tubes of equal dimensions, one nearly full and the other about half full of water, be suspended at opposite ends of a beam, turning freely on a pivot, and let the second tube be so hung as to move in the same vertical straight line, during the vibration of the beam. Directly over this tube let a glass rod of smaller diameter be made to slide vertically through a fixed wire spring capable of holding it steady in any position. On lowering the rod carefully into the second tube so as not to touch its inner surface till the water therein is raised by displacement to the same level as that in the first tube, the two tubes will balance each other, though the original weight of water in each is different.

For if a be the area of the aperture of the tubes, h and h' the heights of the two columns of fluid, w the weight of a unit of water, and P, P' the pressures on the base, we shall have $P = wah$, and $P' = wah'$, the weight of water in the two tubes respectively. Therefore, when $h = h'$ we have $P = P'$.

If the glass rod had been suspended from the beam of a balance during the experiment, it would of course be found to have lost just the weight of the water displaced, or just the additional weight needed to counterbalance the full tube. This additional weight, so to say, was given to the second tube by means of hydrostatic pressure.

Instead of the glass rod a small cylinder of ice attached to a thin piece of wire may be employed, of such dimensions that, when the cylinder is entirely immersed in the water of the second tube, the fluid shall stand at the same level in both, and both be in equilibrium. Now, a given weight of water occupies less space than the same weight of part ice and part water. Consequently, as the ice melts, the column of fluid will sink in the second tube, and be unable to counterbalance the column in the first. The additional weight of water does not exactly replace the hydrostatic pressure withdrawn. The second tube will, therefore, rise.

If the balance be furnished with a long index, the movement will be more easily perceived, and curiously illustrate the different specific gravities of ice and water.

—I am, &c. Edwin Smith.

Nottingham, Sept. 2, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Comptes Rendus. June 17, 1867.

Becquerel, "On some new-discovered Chemical Effects of Capillary Action." A. De la Rive, "Note on a Photometer for Measuring the Brightness of Distant Objects, and on the increased Transparency of the Atmosphere due to the Presence of Moisture." Chevreul, "On the same Subject." J. Lefort, "Researches on the Chemical History of Humus." Pool, "Note on an explosive Compound obtained by treating Glue with Chlorate and Nitrate of

Potash." SILBERMANN, "On some Peculiar Phenomena observed in a Shooting Star on June 11, 1867." REBOUL AND TRUCHOT, "On Ethylate of Amylene, an Isomer of Ethylamylic Ether; followed by some Remarks on the Production of Mixed Ethers." F. C. CALVERT, "On Oxidation by means of Oxygen condensed in Charcoal." LECOQ DE BOISBAUDRAN, "On some Experiments on Supersaturation." C. GIRARD AND P. CHAPOTEAUT, "Contributions to the Knowledge of Ethers." E. MAUMENE, "Answer to Forthomme's Remarks on the Author's Paper on an Improved Fermenting Vat." DUBRUEIL AND LEGROS, "Researches on the Physiological Action of Sulpho-cyanide of Potassium."

June 24, 1867.

ARTUR, "On Becquerel's Memoir on the Chemical Effects of Capillary Action." ZALIWSKI-MIKORSKI, "On the Effect of increasing the Height of the Elements of a Voltaic Battery, the Base remaining unchanged." "An Improvement in the Bunsen Battery." A. BAUDRIMONT, "On the Estimation of Organic Matter, Phosphoric Acid, and Nitrogen in Peruvian Guano and other Manures." EULENBURG AND GUTTMANN, "On the Physiological Action of Bromide of Potassium." J. PERNOD, "On the Preparation of Madder for Calico Printing in the Topical Style." CHEVREUL, "on the same Subject." C. FRIEDEL AND A. LADENBURG, "On a Silicic Mercaptan." R. D. SILVA, "On Compound Ammonias with an Amyle Base." JANSSEN, "On the Composition of the Gases emitted from the Volcano at Santorin.

Vol. 65. No. 1. July.

A. GAUDIN, "On the Special Function of Hydrogen in Acids, and particularly in Polybasic Acids."

Monatsbericht der königlich-Preussischen Akademie. March, 1867.

W. KUHNE, "On the Digestion of Albuminous Substances by the Pancreatic Juice." POGGENDORFF, "On the Use of Paper Pyroxylin as an Electroscope." G. ROSE, "On the Formation of Crystals in Beads of Borax and other Blowpipe Re-agents, regarded as the Cause of the Opacity of such Beads when allowed to cool. "On the Preparation of Anatase and the other Allotropic Forms of Titantic Acid."

Annales de Chemie et de Physique. May, 1867.

G. A. HIRN, "Memoir on Thermodynamics. E. P. BERARD, "Letter to Dumas on the Invention of a Furnace for the Continuous Combustion of Sulphur in Sulphuric Acid Chambers. S. M. JOERGENSEN, "On the Periodides of the Alkaloids.

June.

B. RENAULT, "An Experimental Verification of the Reciprocal of Faraday's Law of the Decomposition of Electrolytes. A. SCHEURER-KESTNER, "Some new Researches on the Theory of Leblanc's Process for the Manufacture of Soda.

Annales du Génie Civil. June, 1867.

E. FERRAND, "On the History, Preparation, Properties, Action on the Workmen employed in the Manufacture and Applications of Coal Tar Dyes." GRIESS, "On Chlorochromate of Diazobenzide, a new Explosive Compound." FORTIER AND PHILIPPE, "On the Use of Carbonate of Ammonia for Washing Wool and Cloth."—On a Method of Renovating Files by Etching with Sulphuric Acid"—"On a new Fuel for Steam Engines, consisting of Peat saturated with Petroleum."

Le Technologiste. June, 1867.

H. WAGNER, "On a new Method of treating poor Copper Ores in the Wet Way. P. LE GUEN, "On a Method of Alloying Bessemer Steel with Tungsten." L. JOULIN, "On the Deposits of Potash and Soda Salts at Stassfurt." A. SCHEURER-KESTNER. "Some new Researches on the Theory of Leblanc's Process." F. STOLBA, "On the Preparation of Sulphurous Acid. E. GOSTMANN, "On the use of Paraffine for checking the Violent Ebullition of Syrup in Evaporating and Vacuum Pans." H. A. ARCHEREAU, "A Method of Manufacturing Oxygen by decomposing Sulphuric Acid, and on using the Gas produced, in Combination with Hydrogen, for Illuminating Purposes. C. PUSCHER, "On the Manufacture of Artificial Meerschaum and Horn." A. PARAF, "On the use of a Glyceric Ether in Dyeing." DE LAIRE, C. GIRARD, AND CHAPOTEAUT, "On Mauvaniline, a new Coal Tar Dye."—"On a Method of Dyeing Sewing Silk Black." C. JACOBSEN, "On a new Marking Ink prepared from Aniline." C. LIEBERMANN, "On a Method of Distinguishing Wool and Cotton in Fabrics and Threads." C. WINKLER, "A Process for Purifying Graphite."

NOTES AND QUERIES.

Table of Densities.—If your correspondent, G. K. Bowntiff, meets with any difficulty in finding a table giving the weight per cubic inch of sulphuric acid at the different specific gravities, he may very easily prepare one by multiplying each specific gravity by 16·358 (the weight in grammes of one cubic inch of water at 16°·7 C), and each result will be the weight in grammes of 1 cubic inch of acid for that specific gravity. Of course, if the result is required in grains, the multiplier will have be be 252·45.—F. J. R. C.

Testing Cognac.—In answer to your correspondent, C. Campbell, I beg to state that the aroma left on slow evaporation of genuine spirits when gently evaporated in the hollow of the hand is so very characteristic that it is used as a criterion in the South of France to distinguish between pure *esprit de vin, esprit de marc de raisin*, and the spiritous fluids obtained from grain and beet-root. It is impossible to entirely eliminate from the latter the fusel-oil, but this is never present in spirits made from wine, which, on the contrary, always contain small quantities of œnanthic and acetic ethers. The smell left on evaporation of spirits not made from wine is so peculiar that it may be even recognised in the ether made from this spirit. Since the ravages occasioned by the grape-disease it will be difficult to procure from France or Spain really genuine spirits, unless specially ordered. The largest distillery in the United Kingdom is almost entirely employed making whiskey for exportation to France. I should say that the ripeness of the wine, its age, the grapes it was obtained from, and the whole process of fermentation, leave an indelible impression on the quality of the spirits obtained. From my own experience, I think it is hardly likely that Mr. Campbell will be able to find a chemical test for the purpose alluded to.—DR. ADRIANI.

TO CORRESPONDENTS.

*** *Owing to the non-arrival of our French Correspondence up to the time of going to press, we are unable to give this week our usual Reports on the Paris Exhibition, the Academy of Sciences and Foreign Science.*

F.J.R.C.—Received with thanks. We shall always be glad to hear from this correspondent.

J. H. Mann, Polytechnic Institute, Troy, New York.—Communication received. The offer came to us through an unimpeachable channel, but, owing to the sudden decease of the gentleman entrusted with the negotiation, the matter is in abeyance. We will therefore hold the communication at our correspondent's disposal, to be either published or returned to him, unless in the meantime we can forward it to the proper quarters.

J. P. O'Brien.—We cannot undertake private negotiations for the sale of chemical works.

Ignoramus.—Nothing whatever is known about the cause of the transparency of metallic particles in solution. Your theory is certainly wrong. Take our advice; avoid theories for the present. Hear what Sir Humphry Davy said:—"When I consider the variety of theories which may be formed on the slender foundation of one or two facts, I am convinced that it is the business of the true philosopher to avoid them altogether. It is more laborious to accumulate facts than to reason concerning them; but one good experiment is of more value than the ingenuity of a brain like Newton's."

Querist.—Our printer will give you an estimate. If you want separate copies of your article you should mention it when you return the proof to our office. It is too late to wait till the CHEMICAL NEWS is published, as the type is distributed on Friday afternoon.

Thomas MacFarlane.—We doubt if a minute description of your system would be admitted to competition if it is only a trifling modification of the process in ordinary use. We imagine that an entirely new process is wanted; there is, however, no harm in trying

V. Cruse.—We regret we cannot give the information required.

D. J. O.—You can get the journals at Asher's, Bedford Street, Covent Garden, or Baillière's, Regent Street.

Rusticus.—1. There is no special memoir that we know of on the subject of nitro-glycerine as an explosive agent. 2. Larkin's magnesium powder lamp is the best.

F. J. Booth.—The camphor weather-glass is only a toy. In your question about the density of the air you put cause for effect.

E. Smith.—The article is received with thanks.

J. Fordine.—An article on the subject will soon appear. We are waiting for the report of the scientific examiners of the foul atmosphere of the railway.

Ellen G.—Tea is not adulterated to the extent you suppose. Your suspicions in the present instance are quite unfounded, as the sample sent us is qurom colouring matter.

Communications have been received from T. Hill; J. Thorley; F. J. R. Carulla; W. Procter, Junr.; T. G. Wormley; M. D. (with enclosure); W. J. Russell; G. F. Rodwell; J. Attfield; Rev. R. Harley, F.R.S.; A. E. Sansom, M.D.; J. Cliff; J. P. O'Brien; T. J. Barker (with enclosure); W. Lawrence; H. Bedford (with enclosure); R. Ward; C. J. Ellam (with enclosure); J. E. Wright; John Brown; Dr. Adiani (with enclosure); H. Armstrong (with enclosure) Henry Denny; J. Spiller; Lewis and Son; Robert Harley; C. L. Lee (with enclosure); P. W. Hofmann (with enclosure); E. Corbett, junr. (with enclosure); W. E. Bickerdike, F.C.S.; John Heywood; Peter Squire; E. Kienmann; John W. Burton (with enclosure).

Books Received.—"Micro-chemistry of Poisons, including their Physiological, Pathological, and Legal Relations."—By Theo. G. Wormley, M.D., with "Atlas" for the same, containing 78 illustrations upon steel. Baillière Brothers, New York. "Thorley's Illustrated Almanack."

St. Mary's Hospital Medical School, London.

The Introductory Lecture, by DR. BROADBENT, October 1st., at 8 p.m.

MEDICAL OFFICERS AND LECTURERS.—Consulting Officers: Dr. Alderson, F.R.S., Dr. Chambers, Mr. Coulson, Mr. White Cooper. Physicians: Dr. Sibson, F.R.S., Dr. H. Jones, F.R.S., Dr. Sieveking, Dr. Markham. Assistant-Physicians: Dr. Broadbent, Dr. Cheadle, Dr. Bastian. Surgeons: Mr. Lane, Mr. Spencer Smith, Mr. Haynes Walton, Mr. J. Lane. Assistant-Surgeons: Mr. Gascoyen and Mr. Norton. Physician-Accoucheur: Dr. Tyler Smith. Ophthalmic Surgeon: Mr. Ernest Hart. Surgeon-Dentist: Mr. Sercombe. Other Lecturers: Dr. Matthiessen, F.R.S., Dr. Randall, Dr. Lawson, Mr. Mivart, Dr. Trimen.

The course of teaching at this School includes adequate preparation for all the Examining Boards and the Public Services, and the higher University Examinations. Special instruction is provided (by separate courses) in Minor Surgery and Bandaging, Ophthalmic and Dental Surgery, Comparative Anatomy, and Mental Diseases. The Clinical System is carefully organised in the general wards, there are also departments for Diseases of Women and Children, of the Eye and Ear, of the Skin, and of the Throat. The scientific teaching is mainly demonstrative. All the resident medical appointments (including the House-Surgeoncies) are open to the Pupils without expense of any kind, and are equivalent to Five Scholarships of the annual value of Fifty Pounds. The Resident Registrarship is of the value of £100 a year, with board and lodging. Two Scholarships of £25 and £20 each, and Prizes in each group of classes, are awarded annually. The Prospectus, with addresses of Professor Owen and Huxley, the Archbishop of York, and Dr. Alderson, President of the College of Physicians, may be obtained on application to

ERNEST HART, Dean of the School.

University of Edinburgh.

The SESSION will commence on Monday, Nov. 4th, 1867.

FACULTY OF MEDICINE.

Dietetics, Materia Medica, and Pharmacy ..	Mon., Nov. 4, 9 ..	Prof. Christison, M.D., 40, Moray-place.
Chemistry	Mon., Nov. 4, 10..	Prof. Lyon Playfair, C.B., 14, Abercrom-by-place.
Surgery..	Mon., Nov. 4, 10..	Prof. Spence, 21 A Ainslie-place.
Institutes of Medicine ..	Mon., Nov. 4, 11..	Prof. Bennet, M.D., 1, Glenfinlas-street.
Midwifery and Diseases of Women and Children	Mon., Nov. 4, 11..	Prof. Sir J. Y. Simpson, Bart., M.D., 52, Queen-street.
Clinical Surgery (Mon. & Th.)..	Mon., Nov. 4, 12..	Prof. Syme, 1, Shandwick-place.
Clinical Medicine (Tu. & Fr.)	Tues., Nov. 5, 12-2	Profs. Bennett, Laycock, and Maclagan.
Anatomy	Mon., Nov. 4, 1 ..	Prof. Turner, M.B., 7, Brunswick-street, Hillside.
Natural History..	Mon., Nov. 4, 2 ..	Prof. Allman, M.D., 21, Manor-palce.
Practice of Physic	Mon., Nov. 4, 3 ..	Prof. Laycock, M.D., 13, Walker-street.
General Pathology	Mon., Nov. 4, 4 ..	Prof. Henderson, M.D., 19, Ainslie-pl.
Anatomical Demonstrations	Mon., Nov. 4, 4 ..	Prof. Turner.

ROYAL INFIRMARY at Noon, Daily.

Practical Anatomy, under the superintendence of Professor Turner.

Practical Chemistry, under the superintendence of Professor Lyon Playfair.

Analytical Chemistry, under the superintendence of Professor Lyon Playfair.

Practical Physiology, under the superintendence of Professor Bennet.

MATRICULATION.—Every Student, before entering with any Professor, must produce a Matriculation Ticket for the ensuing Session. Tickets will be issued at the Matriculation Office, at the College, every lawful day, on and after 7th October, from ten till four o'clock. Enrolment in the General Album is the only legal record of attendance in the University.

LIBRARY.—The Library will be open for the purpose of giving out Books to Students, either on loan, or for reference in the Hall appropriated for that purpose, every lawful day during the Winter Session, from ten o'clock A.M. till four o'clock P.M.; except on Saturdays, when it will be shut at one o'clock precisely.

Every Student applying for Books must present to the Librarian his Matriculation Ticket for the Session, with the Ticket of at least one Professor.

Every Book taken out must be returned within a fortnight, uninjured.

N.B.—Information relative to the Curricula of Study for Degrees, Examinations, &c., will be found in the University Calendar, and may be obtained on application to the Secretary at the College.

A Table of Fees may be seen in the Matriculation Office, and in the Reading-room of the Library.

By order of the Senatus.

14th September, 1867. PHILIP KELLAND, Sec. to the Senatus.

City of London College, Leadenhall Street, E.C.

The CHEMICAL LECTURES will re-commence on Monday Evening, Oct. 14. Lecturer, Rev. B. Gibsone, M.A., B.Sc., F.C.S.

Advanced Class, 7 to 8 p.m. Practical Chemistry, Testing and Systematic Analysis. Each Student works separately.

Junior Class, 8 to 9. Elementary Principles applied to the Metals.

Fee 5s. per quarterly term.

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INSTRUCTION in PRACTICAL CHEMISTRY, and Evening Classes for the Study of CHEMISTRY, BOTANY, MATERIA MEDICA, &c.

TO PHARMACEUTICAL AND OTHER STUDENTS.

Mr. J. C. BRAITHWAITE, for thirteen years Principal Instructor in the Laboratories of the Pharmaceutical Society of Great Britain, and Demonstrator of Practical Pharmacy, Pharmaceutical Latin, &c., wishes to inform his old Pupils and others that he continues to devote his whole attention to Education. The Session 1867—1868 will commence on the 1st of October, when

Mr. BRAITHWAITE'S Laboratory, which has been enlarged during the recess, will be re-opened at 10 a.m. for Instruction in Practical Chemistry as applied to Pharmacy, Medicine, Analysis, &c. Pupils can enter at any period. Terms moderate.

THE CHEMICAL and TOXICOLOGICAL CLASS meets as usual every Monday and Thursday Evening, at 8 p.m., commencing October 3rd.

The LATIN CLASS for the reading of the Pharmacopœia, Physicians' Prescriptions, &c., every Tuesday and Friday Evening, at 8 p.m., commencing October 1st.

The BOTANICAL and MATERIA MEDICA CLASS, every Wednesday and Saturday Evening, at 8 p.m. The usual EXCURSIONS for the STUDY of ACTUAL BOTANY will commence at 10 a.m., October 2nd.

Fee to either of the above Classes Half-a-Guinea per Month; to the Botanical Excursions only. Half-a-Guinea per Eight Lessons payable in advance. upils can enter at any period.

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THE CHEMICAL NEWS.

Vol. XVI., No. 409.

ON SOME POINTS IN CHEMICAL GEOLOGY.

By DAVID FORBES, F.R.S., &c.

It must be admitted that the study of geological chemistry has more particularly of late years met with but little attention from British chemists; this apparent neglect, however, cannot be attributed to any want of appreciation of the importance of this branch of the science, but is rather due to the greater attractions possessed by the more novel and extensive field of exploration now opened up by the rapid strides of organic research, which appears to have all but absorbed the supply of labourers in the domain of chemical science.

The appearance in a late number of this periodical of a somewhat lengthy communication on chemical geology, was hailed by the author of these remarks with much pleasure, and as he has already long devoted himself to similar inquiries, and believes that a little discussion on the subject might prove useful in exciting afresh the interest of those familiar with this branch of the science, and might assist in arousing the study of chemical geology from its present semi-torpid state in England, does not consider further apology necessary for laying before the chemical public some observations upon the theoretical views in geological chemistry recently propounded by Dr. Sterry Hunt,* which are at considerable variance with those hitherto generally accepted by those chemists who have more specially studied this branch of the science.

In the *Geological Magazine* for this month the author has treated of the same subject more from a physical and geological point of view, and therefore will in the present communication as much as possible confine himself to a more purely chemical examination of the arguments and data brought forward by Dr. Hunt in support of his propositions.

In explaining the origin of this globe, Dr. Hunt adopts the nebulous hypothesis, imagining the whole of the chemical elements now constituting its mass, to have been originally present as "dissociated" gases, in a state of chemical "indifference" to one another, due to the intensely high temperature to which he supposes them to have originally been exposed. A lowering in temperature is then assumed to have brought about the chemical combinations of these elements, and the subsequent condensation of their compounds into the form of a sphere of igneous fluid matter surrounded by a dense gaseous atmosphere.

The old hypothesis of Davy assumed a similar result as being due to the heat eliminated by the combination of the elements themselves; but in Dr. Hunt's lecture he does not explain how he imagines the intense heat which originally caused the elements to become "dissociated and indifferent" to have arisen.

According to Dr. Hunt, this igneous sphere when cooling commenced to solidify at its centre, and extended outwards towards its exterior so as to produce a globe solid to the core, his words being, "The cooling in a mass like this would be just like the cooling of a great bath of metal or sulphur—*i. e.*, in other words, the condensation or congelation would commence at the centre and extend outwards towards the surface."† It is almost superfluous to observe that everyone knows that this is not the case with either sulphur or metals when cooling under ordinary circumstances; for chemists and others are accustomed in preparing crystals of sulphur or metals to allow such a melted bath to cool until its exterior has alone become solidified, and then, after making an orifice through the crust to pour out the still fluid central mass, which consequently has not solidified first.

Dr. Hunt, however, explains that in the case of a cooling globe the central part would solidify first, owing to its melting point being much more elevated by the pressure to which it was subjected, and appeals to experiments of the late Mr. Hopkins‡ as conclusive proof that the melting points of bodies do become (*ad infinitum*) elevated in proportion to the applied pressure.

Without disputing that the fusing points of many bodies may be elevated by pressure, a reference to the experiments appealed to by Dr. Hunt will show that (in the present instance at least) they are not at all conclusive. Setting aside the experiments made on spermaceti, stearine, and wax, which being organic substances decomposed at comparatively low temperatures, and possess no analogy whatever to the mineral compounds here under consideration, the other experiments of Mr. Hopkins were made on sulphur and metallic alloys, and consequently their results should be particularly applicable to the case of a "bath of metal or sulphur," alluded to as a simile by Dr. Hunt. On reference to the report in question, however, it will be at once perceived that the result of these experiments cannot at all warrant deductions so conclusive as Dr. Hunt has drawn from them; for Mr. Hopkins expressly states that in the case of the metallic alloys experimented upon, "*he has not detected any elevation of fusing temperature acquired by increasing the pressure.*" Again, the experiments made with sulphur afforded the following results:—

Pressure in atmospheres.	Pressure in lb. per square inch.	Fusing point in Centigrade.
1	15	107·2
520	7,790	135·2
793	11,990	140·5

In other words expressed, these figures show that the melting-point of sulphur under a pressure varying from 1 to 520 atmospheres, becomes elevated in temperature at the rate of 0·0394° Centigrade per atmosphere of applied pressure, but that subsequently up to 793 atmospheres, the highest pressure employed in these experiments, this rate diminished greatly, becoming little more than one quarter of the previous rate of increase, or only 0·0101° Centrigrade for each atmosphere. It may not unreasonably be supposed, therefore, that greater pressure would still further lower this ratio, and eventually reduce its fusing-point once more to the temperature at which it melts when not subjected to any pressure, and it may even be imagined that subsequently, as in the case of water, a still higher pressure might actually cause depression instead of elevation of its fusing-points.

It is admitted now that there is a limit to the increase in density of bodies when subjected to pressure, or rather that after a certain point is reached that the increase of density of a body bears a less and less ratio to the actual compressing force employed; and it may be imagined that the same result would be also found to take place in the relations of the increase in temperature of the fusing-points of bodies to the pressure applied. It seems not improbable even that substances when once brought to the condition of maximum density might not then have the temperature of their fusing-points further elevated by increase of pressure.

Whether this be or be not the case, however, Dr. Hunt's argument would not be valid unless he at the same time brought forward proof that the substance of the earth is homogeneous throughout, or made up of substances possessing the same or nearly the same fusing-points as that of the original external crust or layer. Now, there seems

* Dr. Hunt's *resumé* of his lecture, "On the Chemistry of the Primeval Earth," Chemical News, vol. xv., pp. 315—317; short-hand verbatim report of same in *Geological Magazine*, vol. iv., pp. 357—369, containing more details than the above abstract; also Dr. Hunt's communications to the *Academie des Sciences*, 22nd April, 1867, noticed in Chemical News, vol. xvi., p. 148.

† *Geological Magazine*, vol. iv., p. 361.

‡ British Association Report, 1854, page 57.

no grounds for believing that such can be the case; for since the mean specific gravity of the earth is about double that of the substances composing its known exterior crust, it would appear all but certain that the interior mass must be composed of substances different in composition, and much more dense than those known to form the superficial parts of the globe;‖ and this would indicate the great probability of there being in the interior of the earth an immense accumulation of metallic bodies of great density; and as the fusing points of such substances are acknowledged to be immensely lower than that of those composing the known crust of the earth, it might be advanced in opposition to Dr. Hunt's views that this difference would more than counterbalance the tendency to solidify at the *centre* in the case of the fusing points being really even considerably elevated by the effects of pressure.

For these and many other reasons, some of which will be afterwards noticed in the course of this discussion, the author cannot agree with Dr. Hunt that the earth is solid to the core, but believes that there is still some vast reservoir or reservoirs of molten matter in its interior.

In entering into the consideration of the chemical history of the earth from the moment of solidification Dr. Hunt now bases the whole of his views of the reactions and the entire exposition of the chemical changes which took place in this newly-created globe upon the constitution of the atmosphere with which it then was surrounded; it consequently becomes of the highest importance to ascertain by careful scrutiny as to whether his views upon this subject are sound and likely to meet with acceptance in the chemical world.

This atmosphere according to Dr. Hunt was intensely acid and of great density, and contained all the carbon, sulphur, and chlorine in combination respectively, as carbonic, sulphurous and hydrochloric acids along with the nitrogen, steam, and "a probable excess of oxygen."

That the nitrogen, steam, and carbonic acid would be there is readily admitted, but it may fairly be inquired whether any chemist can believe, that after the grand scene of general combination of the elements occurring under the circumstances assumed by Dr. Hunt, that (even if possible?) it could be at all *probable* that *an excess of oxygen* could exist along with the vast amount of sulphurous acid which was present, if that gentleman's premises were correct. Further, the improbability of such an atmosphere containing a mixture of heated hydrochloric and sulphurous acid gases, may be inferred from Dumas' researches;§ that chemist having long ago shown that these gases when mixed together, react and mutually decompose one another with the formation of water, chlorine, and sulphur.

The strong affinity which sulphur has for the metals is well known, as also the fact that sulphurous acid is itself readily decomposed by many metals, with the formation of metallic sulphides and oxides; and the inference which the author would deduct therefrom is that so far from all the sulphur having at this crisis of chemical combination gone into the atmosphere as sulphurous acid, it in reality united itself to the metals, and thus formed dense sulphides which at once sunk through the external and lighter fluid layer of the still liquid igneous sphere, and there remained in its interior protected from oxidising action.

The existence in Dr. Hunt's imaginary atmosphere of all the chlorine in the form of hydrochloric acid is also protested against. Independently of the probability of in such event the oxygen and hydrochloric acid gas reacting upon one another, and reproducing chlorine with the vapour of water; it is contended, that hydrochloric acid was not even likely to have been formed at all under the circumstances here alluded to. Amongst the most stable, if not the most stable of all the compounds of chlorine are the alkaline chlorides—for example, chloride of sodium or salt, and it may be gathered from Dr. Hunt's lecture that he cannot but admit that there must have been abundance of metallic sodium present at the moment of the general combination of the chemical elements. Chemists therefore will require of Dr. Hunt an explanation as to why he in such a case, supposes the chlorine to have united itself with the hydrogen to form hydrochloric acid, instead of at once combining with the equally accessible sodium, for which chlorine is known to possess a stronger affinity than for hydrogen; chlorine unites even at ordinary temperatures and without compulsion directly with sodium, and still more energetically at more elevated temperatures; and that its affinity for sodium is far stronger than for hydrogen is shown by the fact that hydrogen does not decompose chloride of sodium even with the assistance of heat, whilst, on the contrary, the chloride of hydrogen or hydrochloric acid is decomposed and yields up its chlorine to the sodium and various other metals, even in the cold.

When summing up the arguments advanced on both sides, as to the constitution of the atmosphere which enveloped the earth at this early period of its existence, the writer confidently believes that chemists will agree with him in disputing the probability and even possibility of such a chlorhydric and sulphurous atmosphere as Dr. Hunt has attempted to realize, and thinks with him that the main differences between the air of that period and the present age would be in the large quantity of carbonic acid and water, along with probably a much less amount of oxygen.

To elucidate the chemical reactions which characterised this stage of the earth's history, Dr. Hunt states that they were "just what would now result if the solid land, sea and air were made to react upon each other under the influence of intense heat"; it is well known that temperature may greatly modify chemical action, but as Dr. Hunt's ultra-igneous theory* deals with the effects of heat so immensely intense as to "dissociate" and vaporize even the most refractory bodies, it must be admitted that his comparison is quite correct, but at the same time it is not admitted that the results of such reactions would be such as Dr. Hunt represents them to be when he states, "to the chemist it is at once evident that from this would result the conversion of all carbonates, chlorides, and sulphates into silicates, and the separation of the carbon, chlorine, and sulphur in the form of acid gases"; on the contrary the author believes that the chemist who knew anything about geology would remember the vast stores of carbonaceous matter locked up in the earth's bowels, and deduce therefrom that the carbon of these would react upon the sulphates, converting them into sulphides without their evolving all the sulphur they contain in the form of acid gas, as Dr. Hunt would have us to believe—nor would he admit that all the chlorides were converted into silicates, or that as Dr. Hunt elsewhere† tells us that the chlorine of the sea-salt would be expelled into the atmosphere in the form of hydrochloric acid gas; for although

‖ Knowing that there is a limit beyond which substances increase but little in density when subjected to additional pressure, it may fairly be assumed that the materials of the known external crust would have attained their maximum density long before the conditions here required would have been arrived at; a simple calculation will show that if we regard the mean density of the earth as 5·3 and that of the surface crust as one half this, or 2·65, and further imagine the earth to be composed of three concentric layers of equal thickness, and of densities increasing respectively in arithmetical progression, there would be respectively an outer crust of specific gravity 2·65, an intermediate zone of specific gravity 10·7, and a central kernel of specific gravity 18·8. If instead of three such zones, more than this number are imagined, then the calculation will show that the specific gravity of the central kernel will come out still higher than 18·8.

§ *Traite de Chimie*, t. i. p. 146.

* The idea of igneous action propounded by Hutton and his followers the Plutonists, is but a milk-warm theory when compared to that of Dr. Hunt, who whilst protesting against the earth having been formed "entirely by fire," discourses eloquently on its creation from a state of ultra incandescence at temperatures so elevated as would have been far beyond the conception of Hutton himself.

† *Geological Magazine*, vol. iv. p. 362.

he would be fully aware that silica, sea-salt, and water if exposed to heat under forced circumstances, as for example when heated in confinement or when the vapour of water and salt be passed over highly heated silica, that in such case silicate of soda would be formed and hydrochloric acid evolved; this, however, would not be the case in nature in the event alluded to by Dr. Hunt, for the water in the sea would be all evaporated at the first approach of the heat, leaving the anhydrous salt, which, being also volatile, would be next sublimed as soon as the heat became more intense; the unaltered quartz remaining behind, before it had even attained a temperature sufficient to have effected the supposed reaction.

The sea, which would cover the earth's surface as soon as this had cooled down sufficiently to allow of the condensation of the vast accumulation of aqueous vapour in the atmosphere, would, the author believes, become salt the moment it appeared upon the surface of the globe, since the water would at once dissolve the chlorides formed by the direct combination of the metals with chlorine, as previously alluded to, and thus produce a solution of the chlorides of sodium, potassium, calcium, magnesium, &c., along with iodides and bromides which owed their origin to similar reactions. As Dr. Hunt does not attempt to explain why the chloride of sodium should so preponderate over that of potassium or the other alkalies, this question may be reserved for future research and speculation.

Dr. Hunt however accounts for the saltness of the sea by an explanation totally different from the above, and after stating that "the depressed portions of half cooled crusts would be flooded with a highly heated solution of hydrochloric acid," proceeds to inform his audience that this acid deluge would extract the soda along with some other bases from the silicates of the crust, and thus form the salt sea.

Should chemists, however, adopt the author's opinion that the chlorine really had at once united with the sodium to form salt and other chlorides, then it naturally follows that Dr. Hunt's views of this stage in the earth's history are untenable.

For the sake of argument, however, let it be supposed for a moment that Dr. Hunt is correct in insisting upon that all the chlorine and sulphur had ascended into the atmosphere as acid vapours; then it must be asked, What became of the sulphur? As Dr. Hunt did not inform his audience in his lecture, we must inquire ourselves. The sulphurous acid would naturally convert itself sooner or later into sulphuric acid, and would be condensed and fall down on to the globe, and be carried into the sea.

As now, sulphuric acid is more powerful than hydrochloric acid, it would at once turn out the hydrochloric acid, and convert the chlorides into sulphates, so that, instead of the ocean formed by Dr. Hunt's theory being a salt sea in the ordinary acceptation of this term, it would really be a solution of glauber-salt or sulphate of soda.

There are many reasons for estimating the probable quantity of sulphur contained in the globe as fully as large, if not larger, than that of chlorine; but as the equivalent of sulphur is only 16, whilst that of chlorine is 35·5, it would not require as much sulphur as even one-half the amount of the chlorine present in the sea to convert the entire amount of salt contained in the ocean into sulphate of soda.

Dr. Hunt next makes the surprising assertion that all true limestones are the result of the precipitation of carbonate of lime thrown down from a solution of the chloride of calcium by the action of solutions of carbonate of soda. As Dr. Hunt does not in his lecture advance any evidence whatsoever in support of this statement, it is considered to be purely hypothetical; and it is believed that chemists will still adhere to the opinion that limestones have not been so found, but that they are essentially the result of organic action, as has been very satisfactorily demonstrated by the careful study already made of these rocks by geologists, palæontologists, and microscopists.

It is not probable that either chemists or zoologists will agree with Dr. Hunt's further assertion that "animals can only appropriate the carbonate of lime which they find ready formed," but that they will consider these animals capable of utilising the other lime salts in the sea until, at least, Dr. Hunt brings forth convincing evidence to the contrary.

Sorby's admirable microscopical investigations have clearly demonstrated that the magnesian limestones and dolomites in reality only represent ordinary limestone beds, altered *in situ* by the infiltration of magnesian solutions. Dr. Hunt, on the contrary, claims to have discovered that magnesian limestones, dolomites, and gypseous beds have originated through chemical "reactions hitherto unsuspected," and that his experimental researches have proved them to have been formed at a time when the surface of the earth was covered by a dense atmosphere of carbonic acid. In reply to Dr. Hunt, the author would, in plain words, declare his firm belief that geologists, palæontologists, or zoologists will be as little disposed to consider his conclusions even likely to be true, as chemists on the other hand will admit his reactions and experiments to be new.

The former will content themselves with informing Dr. Hunt that every geologist should be aware that the great development of such beds took place at an epoch in the world's history, when air-breathing animals, (both vertebrate and invertebrate), lived upon the face of the earth, and with expressing their surprise that Dr. Hunt could imagine these animals living in an atmosphere of carbonic acid; whilst chemists, on their part, would not be disposed to regard the mutual reactions of the sulphate or chloride of magnesium with carbonate of lime, as possessing novelty, and would further inform Dr. Hunt that, notwithstanding he has considered the results of his experiments on magnesian compounds under an artificial atmosphere of carbonic acid as worthy of being laid before the *Academie des Sciences* of Paris,* that for nearly, if not more, than a quarter of a century these very processes have been in general application on the large scale in the manufactories of preparations of magnesia both in England and Ireland.

In concluding these remarks, the author can only but record his protest against the soundness of the arguments propounded by Dr. Hunt in his explanation of the origin of granite and the formation of the metamorphic and eruptive rocks, both ancient and modern, as in this present communication the space at disposal will not allow of more extended discussion. On some future occasion, however, an attempt will be made to take the chemistry of the formation and alterations undergone by these rock-masses also into consideration.

Quekett Microscopical Club.—The monthly meeting was held at University College, on Friday evening, September 27, Mr. A. E. Durham, President, in the chair. Mr. Glade read a paper on "snails teeth," in which he described those organs of mollusca known as the tongue or palate, consisting of a long and narrow strip of membrane on which are arranged, in various patterns, successive series of strong recurved teeth, by the rasping action of which the animal is enabled to obtain its food. By this means the carnivorous mollusca bore through the shells of the animals on which they prey. The numbers, arrangement, and shape of these teeth afford to naturalists a means of determining species. Dr. Maddox exhibited a collection of beautifully executed micro-photographs of deep sea soundings, many of the objects being magnified 3,000 times.

* *Comptes Rendus*, April 22, 1867, lxiv., p. 815.

ON THE COMMERCIAL ANALYSIS OF SOME OF THE PRODUCTS AND MATERIALS OF THE ALKALI MANUFACTURE, &c.

By C. R. A. WRIGHT, B.Sc., F.C.S.

(Continued from page 171.)

Where the hypochlorite contained in a sample of bleaching powder, which may also contain chlorate, is to be determined, the only safe and convenient method is that of Penot, *i. e.*, by the use of an alkaline solution of As_2O_3. When the chlorate likewise is to be determined, it may be expeditiously done by heating the sample with a known quantity of the same arsenite solution, and addition of HCl; from the difference between the quantities of arsenite peroxidised in the two instances the chlorate is readily known. The writer has found bleaching powder of commerce to contain several per cents of calcium chlorate, even when newly made; in older samples the chlorate has been occasionally found to represent as much as 10 per cent of available chlorine, or fully one-fourth of the amount originally present; thus indicating overheating either in the process of manufacture or subsequently.

(V.)—Manganese Ore.—The mode of analysis of manganese ores usually adopted is that of Fresenius and Will, viz., estimation of the CO_2 evolved by acting on an oxalate in presence of SO_4H_2. Although capable of yielding the most accurate results, this process is usually misapplied in such a way as to indicate 2, 3, and more per cents of "available binoxide" over and above that really present. In order to shorten the time requisite for analysis the apparatus, weighed cold previously to the expulsion of CO_2, is usually weighed whilst quite hot the instant the reaction is complete; thus errors of varying amount are introduced, the apparatus always appearing to weigh less while hot than when cold on account of the effect of the ascending current of warm air buoying up the scale-pan, &c.; the writer has found differences of from 1 to 3 per cent between the results obtained by weighing the apparatus while quite hot, and those got by allowing it to cool completely before weighing. Again, many kinds of manganese ore contain perceptible quantities of carbonate in the gangue, and frequently the commercial analyst does not take the trouble to estimate and subtract the CO_2 evolved from this source. Through haste, also, the CO_2 may be liberated too rapidly to get perfectly dried before escaping from the apparatus. Lastly, the CO_2 evolved is considered to represent the available MnO_2 present, whereas it represents $\frac{87}{55}$ of that amount, 55 being the generally admitted equivalent of manganese. From one or all of these reasons it is by no means unfrequent to find the percentage reported by a commercial analyst 4 or 5 per cent above what is really present; a matter of considerable importance to the purchaser who pays according to the certificate of analysis. Practically speaking, therefore, volumetric methods requiring less time or attention on the part of the analyst, are more likely to give correct results in cases where accuracy must be sacrificed to speed, which is too often the case when low fees are demanded for analytical work.

In order to compare the results obtainable by the better known processes for the valuation of manganese ores, the following methods were tried with the same sample of uniformly mixed finely powdered ore.

(1). Fresenius and Wills' process: oxidation of oxalate and estimation of CO_2 produced by loss of weight.

(2). Bunsen's process: distillation with strong hydrochloric acid and reception of chlorine evolved in potassium iodide solution, the liberated iodine being determined by hyposulphite of soda and standard iodine solutions.

(3). Mohr's process: distillation with hydrochloric acid, reception of chlorine evolved in an alkaline arsenite solution of known strength, and estimation of unoxidised arsenite by standard iodine solution.

(4). Price's process: boiling the ore with hydrochloric acid and a known amount of As_2O_3, in a flask to which a bulb tube is attached to prevent the loss of $AsCl_3$, estimation of unoxidised As_2O_3 by a solution of permanganate.

(5). Price's process modified: SO_4H_2 used instead of HCl, and accordingly an ordinary flask being used instead of the flask and bulb apparatus.

(6). Otto's process: boiling with a known amount of a ferrous salt, the excess of iron being determined by a standard solution of potassium di-chromate, or permanganate.

These methods gave the following results:—

	Name of method.	Percentage of available binoxide found.	Difference from mean.
(1).	Fresenius and Wills'	65·49	+0·04
	,, 2nd experiment	65·43	−0·02
(2).	Bunsen's	65·41	−0·04
	,, 2nd experiment	65·63	+0·18
(3).	Mohr's	65·46	+0·01
(4).	Price's	65·49	+0·04
(5).	,, modified	65·60	+0·15
	,, ,, 2nd experiment	65·35	−0·10
(6).	Otto's	65·30	−0·15
	,, ,, 2nd experiment	65·36	−0·09
	Mean result	65·45	

In no case is there so great an error as $\pm 0{\cdot}2$ from the mean result. In point of speed Fresenius and Wills' is very good, but, as usually employed, is open to the objections previously stated; and when any carbonate is contained in the ore, requires a double estimation. Bunsen's and Mohr's are both speedy, but are troublesome in a commercial laboratory, and require accurate weighings on account of the small amount of substance taken. The latter objection also applies to Otto's process. Price's process and its modification are both open to the objection that permanganate does not act absolutely uniformly on As_2O_3, and that a reddish manganic salt is produced by the reaction; for technical purposes, however, this error is rendered negligible by not taking a very large excess of As_2O_3, and standardising the permanganate by an arsenious solution of known strength. In performing the process with SO_4H_2, the weighed As_2O_3 should be placed in a flask, and boiled with sufficient pure sulphuric acid diluted with twice its bulk of water to dissolve it; the weighed manganese ore is then dropped in, and the whole boiled until no black specks of MnO_2 are visible. For every gramme of manganese ore of 70 per cent available peroxide 0·85 grammes of As_2O_3 is sufficient, leaving thus only a small portion of unoxidized As_2O_3 to be determined by the permanganate, which should be standardised by a solution of a known weight of As_2O_3 in sulphuric acid. If any considerable excess of As_2O_3 have been used it will be more convenient to dilute the acid fluid obtained after boiling with the manganese ore to a known volume—say 300 c.c.— and filter off an aliquot portion for titration by permanganate.

Occasionally, manganese ores contain admixtures of magnetic oxide of iron, ferrous carbonate, or other iron compounds not fully oxidised to the ferric state. Accordingly, when treated with hydrochloric acid, the chlorine given off will be a measure, not of the total MnO_2 present, but of that MnO_2 over and above what is requisite to peroxidise the ferrous compounds. In order to see how the presence of ferrous compounds affects Fresenius and Wills' process, known weights of pure $FeSO_4+(NH_4)_2SO_4+6H_2O$ were treated along with weighed portions of the manganese ore previously experimented on in the CO_2 apparatus with the following results:—

	A.	B.	C.
Percentage of MnO_2 corresponding to the CO_2 evolved	62·62	61·38	45·46
,, ,, Ferrous salt used	2·71	4·14	20·58
Total	65·33	65·52	66·40

It therefore appears that even when a considerable amount of ferrous compound is present the CO_2 evolved corresponds, as in the processes depending on the evolution of chlorine, not to the whole MnO_2 present, but to that left after the ferrous compound is oxidised. In the case of Price and Otto's processes the same will evidently be the case.

ON METEORS.*

By Professor ALEXANDER HERSCHEL.

A QUESTION which at present agitates the minds of physical astronomers is, to ascertain whether a slight acceleration of the moon's apparent motion can be attributed to a lurking error in the calculations of its place, or whether the earth, in the course of ages, has lost a small portion of its speed of revolution round its axis. The latter alternative would appear to explain the fact that the lunar tables, which exactly represent the moon's apparent motion at the present time, do not absolutely give the hour of the day of an eclipse which happened when the sun was setting at Babylon some hundred years before the Christian era. The eclipse began, according to the tables, when the sun was already below the horizon, and it would be invisible at Babylon. But if the earth's rotation, instead of being uniform, were a little more rapid in former times than it is at present, the sun, instead of being set below the horizon of Babylon, would appear eclipsed above it, as the phenomenon was in reality observed. To account for a slower rotation of the earth about its axis at the present time than that which it possessed formerly, the friction of the tides has been supposed to play an important part in checking its velocity. A slow accumulation of meteorites upon the earth's surface, although not appreciably altering the figure and dimensions of the globe, must yet, in the course of many ages, produce an average effect of diminishing its velocity of revolution. The change of a hundredth part of a second in the length of the day, since the time of the earliest observations, would explain the small error which astronomers have discovered, and the cause of which still eludes their search.

Damages to life and property by the fall of meteorites are, from the generally small size of aërolites, among the rarest catastrophes on record. Yet a Franciscan monk was struck and killed by an aërolite, at Padua, in the year 1660, and the Italian philosopher Zerzago, wonderfully concerned at the event, inquired if the stone could not have been projected from a volcano on the moon. At a later period of discovery with regard to meteorites, this conjecture received considerable support, but it was finally rejected as insufficient when it was found that aërolites move with velocities much greater than that of satellites of the earth.

In the year A.D. 1719, a meteor of unusual size appeared in England, to which trigonometrical calculation assigned a diameter of at least a mile, a velocity of three miles per second, and a height in the atmosphere of sixty geographical miles. A detonation like thunder shook the houses as it passed. Dr. Edmund Halley, who was then Professor of Astronomy at Oxford, described the appearance of this meteor. He held the opinion of Aristotle that the meteor was caused by the kindling of a tract of inflammable gas, collected in a long train at the top of the atmosphere, and there exploding. Aristotle's opinion cannot be entertained, on account of the rarity of the atmosphere at great heights being insufficient to support the vivid illumination of large meteors by simple inflammation and combustion of a gaseous mixture. It was, according to the opinion of Dr. Wallis, who described an equally large meteor that passed over England at twilight on the 20th September, 1676, thought to be more probable that the fire-ball was a near view of a comet which was seen near the sun about a fortnight later. It deserves to be mentioned that Dr. Wallis occupied the same chair in the University of Oxford in which Dr. Baden Powell, who alone instituted and began the present series of reports of the British Association on luminous meteors, afterwards proved his illustrious successor, and that the views which Dr. Wallis first introduced on the subject of observations of luminous meteors to English readers have been singularly verified in the events of the past year. In the years 1758 and 1783 Dr. Pringle and Dr. Blagden, at that time the Secretaries of the Royal Society, described two of the largest meteors that appeared in the last century in England. Their calculated height in the atmosphere was about 50 miles, and they were accompanied, like that described by Halley, by very loud explosions. The discovery of atmospheric electricity had hardly been made when these two writers attributed the appearance of large meteors to the same cause as that which gives rise to lightning in the lower regions of the atmosphere. The character of the discharge of electricity in exceedingly rare gases was, however, beginning at the time to be studied, and Lichtenberg's experiments at Göttingen convinced Chladni at Wittemberg that the real explanation of fire-balls had not yet been discovered. In the Mineralogical Museum of St. Petersburg a large mass of metallic iron, weighing about seven hundred-weights, had been brought by Pallas, the geologist and explorer, from the summit of the hill of Krasnojarsk, in Siberia, where it was found. The origin of the mass was a vexed question with geologists when, in the year 1794, Chladni published his work on "The Iron Mass of Pallas, and on Other Masses of Iron and Stone Reputed to have Fallen from the Air." In this work Chladni supposes that all the accounts hitherto received of the falls of aerolites were correct, and he presents a catalogue of them, together with all the accounts of large fire-balls which he was able to collect. Chladni conceived that a class of cosmical bodies exists in all parts of the solar system, each forming by itself a peculiar concourse of atoms, and that the earth from time to time encounters them, moving with a velocity as great as its own, and doubtless in orbits of very various eccentricity round the sun.

Chladni further assumed that a certain property of compressed air, which can be readily exhibited by an instrument called a match-syringe, produces the vivid light and heat of combustion which these bodies exhibit when they are first brought into collision with the outer strata of the atmosphere. When air is confined by a piston in a tube, and the piston, carrying a piece of tinder or other light substance at the end, is suddenly forced into the tube, the heat developed by the compression of the air is so great as to ignite the tinder. The passage of a celestial body through the atmosphere must be intensely rapid, so that before the air can make its escape from the front of such a projectile, it must necessarily undergo a violent compression of the kind exemplified in the match-syringe—the heat developed on its surface must, doubtless, far surpass what can be produced by mechanical means. A series of accurate experiments was made by Dr. Joule, from which it may safely be concluded that a velocity of transit through the air, which is not uncommonly observed in meteors, of thirty miles in a second, would produce upon the surface of the meteoric body a heat sufficient to fuse, and probably also to volatilise, the most refractory substances. Not only the thin glaced surface or crust with which aërolites are invariably covered, but also the appearance of fire-balls and shooting-stars can be satisfactorily explained on these assumptions. Astronomical observations are only required to determine what is the real course of the meteoric particles in space; what is their law of distribution; what is the class of orbits which they pursue;

* From a lecture delivered before the British Association, at Dundee.

and finally, what is their history, either as independent bodies or as emissaries from the train of some other well-known bodies of the visible universe. The first astronomical observations of the kind necessary to confirm the theory of Chladni were those conducted by Brandes and Berzenberg, at Gottingen, in the year 1798, on the heights and velocities of shooting-stars. It was found that shooting-stars appear at a surprising height in the atmosphere, and move with the extravagant velocity which large aërolitic fire-balls were already known to have. The first indication was thus gained that shooting-stars are, in fact, pigmy aërolites, and that aërolites are a gigantic kind of shooting-stars. Observations of luminous meteors have now divided themselves into three classes, for each of which a separate investigation leads to the uniform result that the hypothesis of Chladni is the only one which bears upon its face the stamp of truth. In the principal division of the subject (to which Professor Maskelyne has given the name of aërolites), it was shown by Edward Howard, in the beginning of the present century, that meteoric stones differ essentially from terrestrial rocks, by abounding with metallic iron. But they agree among themselves, by having, in every case which he examined, the rarer metal nickel for an ingredient. Chromium was afterwards shown by Laugier to be an even more constant companion of iron in meteorites than nickel. Copper, tin, and lead, soluble chlorides of sodium and potassium, carbon, in the form of graphite, and once occurring as a carbonaceous peat-like mass, and in one other case as a volatile substance —have been found in meteorites; but no new element has been discovered which is not already known to exist upon the earth. Quite recently, the Master of the Royal Mint, Prof. Graham, has found an abundance of hydrogen gas occluded, or stored up, in the mass of a meteoric iron. The similarity of composition of all the members of the solar system receives from these discoveries an argument of credibility quite as strong, and, indeed, much stronger, than that which can be drawn from an examination of the sun's light in the spectroscope; because, in the case of meteorites, bodies evidently belonging to the celestial spaces can be handled, and their materials have been freely analysed. Among the largest aërolite falls of modern times, two celebrated examples have occurred in France, and two took place in Austria and Hungary. A violent explosion was heard at L'Aigle, in Normandy, and at a distance of eighty miles round L'Aigle at one o'clock in the afternoon of the 26th of April, 1803, a few minutes before the explosion was heard, a luminous meteor with a very rapid motion appeared in the air, and the explosion heard at L'Aigle was caused by the bursting of the meteor. Two thousand stones fell at L'Aigle, upon trees, pavements, and the roofs of houses, so hot as to burn the hands when touched, and one person was wounded by a stone upon the arm. The shower extended over an oval area nine miles long and six miles wide, close to one extremity of which the largest of the stones was found; but the only description I have seen at all approaching graphic was, that some thought their chimneys were on fire, and rushed out for a pail of water. A very similar shower of stones fell at Stannem, between Vienna and Prague, on the 22nd of May, 1812, when 200 stones fell upon an oval area eight miles long by four miles wide. The largest stones, in this case, were found, as before, near the northern extremity of the ellipse. The third stone-fall occurred at Orgueil, in the south of France, on the evening of the 14th of May, 1864. The area in which the stones were scattered was eighteen miles long by five miles wide, and the largest stone was picked up at the eastern extremity of the area. Lastly, at Kuyahinza, in Hungary, on the 9th of June last year, an aërolite, weighing six hundred-weights, was deposited, with nearly one thousand lesser stones, on an area measuring ten miles in length by four miles wide. The large mass was found, as in the other cases, at one extremity of the oval area, and a luminous meteor, followed by a loud explosion, accompanied the stone-fall, which left a smoky streak, visible in the sky for nearly half-an-hour. A considerable aërolite fell upon the same date in Algiers, at Tadjera, in the present year, and two days later, on the 11th of June, a fire-ball, leaving a streak, visible at least one hour, was seen in full daylight, at sunset, in the north of France, in Switzerland, and in Belgium; and those who were in Paris at the Exposition had doubtless seen many accounts of in the popular papers at that time. Although it was accompanied by a detonation, it discharged no stones, but the coincidence of two stone-falls happening in two successive years on the 9th of June makes it probable that this large fire-ball belonged to the same aërolite date. The largest meteors are obviously divided into two classes, one of which, the bolides, or silent fire-balls, appear to have a looser texture, or to consist of more easily inflammable substance than the rest. They burn very brightly, but without producing an audible concussion of the air. Several true bolides accompanied the last November star-shower. Aerolitic fire-balls, as their name implies, frequently precipitate solid stones upon the ground. Fire-balls of this class are accompanied by a detonation. Four such fire-balls have happened within the last few years, on or about the 20th of November. The list of fire-balls observed hitherto numbers some thousands, and as far as their appearance in comparison with certain shooting-stars is concerned, the latter present a dwarfed resemblance to the former, so that it is probable that no break exists, but that fire-balls of every kind are shooting-stars of a larger stature.

(To be continued.)

VOLATILITY OF THE COMPOUND OF IRON WITH SULPHOCYANOGEN.

By WILLIAM SKEY.
Analyst to the Geological Survey, New Zealand.

When a solution of sesquichloride of iron and an alkaline sulphocyanide is treated with a large excess of hydrochloric acid, there is evolved, even at common temperatures, a notable quantity of a red coloured compound which is best arrested and collected by porous bodies or rough surfaces. It gives the reactions of iron and sulphocyanogen.

The production of this volatile iron compound is easiest observed by placing a solution of the above substances in a shallow vessel resting upon white paper, over which a slightly larger vessel is inverted; in a short time a red coloured ring appears upon the paper. The penetrability of this vapour is such that in a short time it traversed through five thicknesses of thick writing paper.

As thus attached to paper, it did not re-volatilize or change in a neutral atmosphere at a temperature of 200°F.; but on moistening the paper with water, its colour immediately went. In ether, however, it is soluble without change of colour.

The composition of this volatile iron compound I hope to be able to furnish by the next homeward mail. In the meantime I cannot avoid remarking how its volatility at low temperature, its colorific properties, and its production only in presence of a more powerful acid than the hydrosulphocyanic, gives force to the supposition that the iron present in it is united with the element of sulphocyanogen to form a salt radical of the same molecular constitution, probably, as ferrocyanogen, thus:

$$\begin{matrix} & Cy \\ Fe + S & \\ & S \end{matrix} \qquad \begin{matrix} & Cy \\ Fe + Cy & \\ & Cy \end{matrix}$$

the sulphur occupying the place of as many equivalents as cyanogen, at all events with the exception of the compound of sulphocyanogen with tungsten. I should be inclined to view it as differently constituted to the sulphocyanides just described.

BRITISH PHARMACEUTICAL CONFERENCE.

FOURTH ANNUAL MEEIING, AT DUNDEE.

President—PROFESSOR BENTLEY, F.L.S., M.R.C.S., &c.

(Continued from page 167.)

"*On Burgundy Pitch.*"

By DANIEL HANBURY, F.R.S.

The authors of the British Pharmacopœia have defined Burgundy Pitch (*Pix Burgundica*) as a *resinous exudation from the stem of the Spruce Fir, Abies excelsa* DC. (*Pinus Abies* L., *P. excelsa* Lam.) *melted and strained.* They have thus followed the London College of Physicians, which for nearly a century and a half has included this substance in its Materia Medica, indicating in the later editions of its Pharmacopœia a similar botanical origin.

On the Continent the term *Pix Burgundica* (which is not frequently applied) appears to have a less definite signification than with us, being used synonymously with *Resina alba* to designate the resins of various coniferous trees after purification by being boiled in water and strained.

In France as in England the term *Burgundy Pitch (Poix de Bourgogne)* is by the more accurate writers restricted to the melted and strained resin of the Spruce Fir, of which substance the following description is given in the last edition of the Codex:

[*Translation*] Burgundy Pitch is of brownish yellow, solid and brittle in the cold, flowing when warm, very tenacious, having a peculiar odour, and an aromatic taste without bitterness; not completely soluble in alcohol in the cold. There is frequently substituted for it another product called white pitch [*poix blanche*], prepared with *galipot** or a mixture of yellow resin and Bordeaux turpentine, melted and mixed with water; this artificial pitch has a strong smell of Bordeaux turpentine, and a very marked bitter taste. It is entirely soluble in alcohol.

Where then is true Burgundy Pitch manufactured? Is it actually met with in commerce? By what characters may we judge of its purity?

The authors of the British Pharmacopœia mention it as a production of Switzerland, where the Spruce Fir is certainly found in great abundance. But I have it upon excellent authority, that of my friend Dr. Flückiger of Bern, that at the present time no terebinthinous resins are collected in Switzerland for commercial purposes. Neither is true Burgundy Pitch produced in France, as it name would seem to indicate, *Pinus maritima*, Lamb., being in fact the only tree the resin of which is collected in that country as an industrial product.

I examined the various collections of forest-products in the French Exhibition. From Finland I discovered a suite of specimens illustrating this very subject. Baron Linder of Svarta, near Helsingfors, is the exhibitor of the resin of the Spruce Fir in two forms, namely:

1. The crude resin as exuded from the trunk of the tree and described in the following words: "*Barras* ou gomme concrète, adhérente aux sapins *(Pinus Abies)*. Produit brût servant à la fabrication de résine, etc., etc.—Prix 12 francs les 100 kilogr.

2. The resin purified by melting in contact with the vapour of water, and straining. It is thus described on the label attached to the specimen: *Résine jaune* cuite (a vapeur d'eau à chaleur modérée) de *barras* de sapin *(Pinus Abies)*. Prix 40 francs les 100 kilogr.: production annuelle 35,000 kilogr.

Of these two resins, the first is not found in English commerce: the second constitutes genuine Burgundy Pitch, precisely such as may be bought in the London market, The quantity of this purified resin produced annually, it will be observed is very considerable, being equivalent to 77,000 pounds, or more than 34 tons weight.

The Paris exhibition shows that true Burgundy Pitch is also produced in Germany.

Another exhibitor of genuine Burgundy Pitch is Mr. Theodor Müllner, of Hinter Brühl Post Mödling, near Vienna, who shows *Fichtenharz* or crude resin of the Spruce Fir and *Fichtenpech*, which is the same in a purified condition. The latter may be regarded as a type of good Burgundy Pitch.

These contributions to the Paris Exhibition show that the resin of the Spruce is collected for trade purposes in Finland and in Germany,—and in the first named country upon a very considerable scale. It does not, however, appear that it is ever termed *Burgundy Pitch* in the places where it is produced.

Although genuine Burgundy Pitch (usually, it must be admitted, in a very impure state) has been always obtainable in the London market, it is rarely found genuine in the shops,—an artificial compound being very generally supplied in place of it.

In examining the characters of genuine and spurious Burgundy Pitch, I have noted the following differences:

True Burgundy Pitch.	*Artificial Burgundy Pitch.*
Colour dull yellowish brown; fracture shining conchoidal; translucent; some samples contain much water, and are opaque and of a dull grey colour, and require straining to free them from impurities. Odour peculiarly aromatic.	Colour usually more brilliant than that of the true Burgundy Pitch.
Not wholly soluble in alcohol of ·838, but leaves a small amount of fine white flocculent matter.	Odour weak and hardly aromatic.
Placed in contact with double its weight of glacial acetic acid in a vial, is dissolved with the exception a small amount of flocculent matter.	Still less completely soluble in alcohol of. 838.
	Similarly treated, forms a turbid mixture which soon separated into two layers, a thick oily liquid above and a bright solution below

The foregoing characters apply to most of the artificial Burgundy Pitch which I have examined, and may be useful, so far as they go, for distinguishing the genuine from the spurious. The odour of true Burgundy Pitch is in itself an excellent criterion which cannot be conveyed by description. Solubility in glacial acetic acid serves to reveal the presence of fatty matter which is a common, perhaps an essential ingredient in the artificial Burgundy Pitch made in this country.

From what has preceded may be deduced the following

Conclusions.

1. True Burgundy Pitch is the melted and strained resin of *Abies excelsa*, DC.

2. An artificial compound is usually sold in lieu of it, both in this country and on the Continent.

3. True Burgundy Pitch is produced on a large scale in Finland, also of very fine quality in Baden and in Austria.

4. True Burgundy Pitch differs palpably from the artificial, and may be easily distinguished from it.

+ *(Note by translator) Galipot*, dry resin collected in France from the trunks of *Pinus maritima*, Lamb.

Solder for Steel.—The best solder for fine steel work, according to the *American Artisan*, is composed of nineteen parts of silver, one part copper and one part brass. Borax is the best flux.

ON FLUO-SILICATE OF BARIUM.

By M. Fr. STOLBA.

To obtain this salt free from sulphate of baryta and silica, first add to the hydro-fluosilicic acid a little baryta, and separate the precipitate obtained; the filtered acid then contains neither sulphuric acid nor silica, and gives a pure salt by saturation with hydrate of baryta.

The pure fluo-silicate of barium is in the form of small microscopic prisms when obtained by boiling with diluted liquids; these prisms are united in clusters or disposed in stars.

Its density at 21°=4·2772 (mean). It dissolves at 21° in from 3262 to 3319 parts of water, and in 3731 parts of water at 17°; boiling water dissolves about three times as much.

Acids dissolve it more easily, and some salts also increase its solubility. It dissolves at 22° in 272 parts of nitric acid (containing 8 per cent of N_2O_5), and in 448 parts of hydrochloric acid containing 4·25 per cent of HCl.

To dissolve it requires 563 parts of a concentrated and boiling solution of sea-salt; 349 parts of a boiling solution of sea-salt, containing 10 per cent of this salt; 2185 parts of a solution at 10 per cent of sea-salt at 20°; 1140 parts of a solution at 5 per cent at 20°; 306 parts of a solution of saturated sal-ammoniac at 22°; 361 parts of a solution of sal-ammoniac at 15 per cent at 22°.

Dilute sulphuric acid slowly decomposes the fluo-silicate of barium when cold, rapidly with heat. This property may be utilised in the preparation of pure hydro-fluosilicic acid; to do this, digest with heat the fluo-silicate of barium, well divided, with nine-tenths of the sulphuric acid necessary wholly to decompose it, until the filtered liquid contains no traces of sulphuric acid.

Sulphates also rapidly decompose the fluo-silicate of barium, but incompletely. Boiled with the alkaline carbonates, it decomposes, leaving a mixture of silica and carbonate of barium; but some silica which adheres strongly to the sides of the vessel is produced at the same time. Calcined with sal-ammoniac, a large portion is changed to chloride of barium, but a complete transformation is very difficult.

The aqueous solution of fluoride of barium is one of the best tests to ascertain the presence of sulphuric acid in the solution of hydro-fluosilicic acid, or of fluosilicates, it is preferable to sulphate of strontium.—*Journal für Praktische Chemie*, xcvi. 22.

REPORTS OF SOCIETIES.

ACADEMY OF SCIENCES.

SEPT. 30, 1867.

(FROM OUR OWN CORRESPONDENT.)

The Pascal-Newton Forgeries—Sulphuric Acid in Living Mollusca—Transformation of Wood Spirit into Aldehyd—Experiments on Projectiles.

THE secretary, M. Coste, read a letter, on the Pascal documents, from Mr. Robert Grant, Regius Professor of Astronomy at the University of Glasgow, transmitted by M. Le Verrier, and inserted also in the *Times*. The learned author of the history of physical astronomy demonstrated invincibly—and we agree with him—that the numbers expressing the masses of the sun, the earth, Jupiter and Saturn, the densities of these bodies, and the force of gravity at their surface, that are found in Pascal's notes, were copied from the third edition of the *Principia* given by Newton in 1726; and from this simple fact Mr. Grant concludes that *all the mass of documents communicated by M. Chasles to the Academy of Sciences are forgeries*. Evidently this conclusion is not contained in the premises, and Mr. Grant errs against the rules of logic. He ought to have confined himself to his first alternative: either Pascal had received from an unknown observer the elements of calculation identical with those of Newton; or, the numbers of his note had been simply copied from the third edition of the *Principia*; and this note is not in Pascal's handwriting.

M. Chasles confessed that it is difficult to explain the coincidence pointed out by Mr. Grant; but his letter does not invalidate the capital fact of the relations between Pascal and Newton, corroborated by irresistible proofs. Here is a very striking one. In one of his letters to Huyghens, Pascal defined the quantity of movement, and gave as its value the product of the mass by the square of the velocity, and deduced from this expression different practical conclusions. Huyghens, in his answer, expressed to Pascal the fear of an error on his part. The quantity of movement, he said, was proportional, not to the product of the mass by the square of the velocity, but to the product of the mass by the velocity. The two letters of Pascal and Huyghens are in the hands of M. Chasles; also, a letter in which Newton communicates to Huyghens this same definition of the quantity of motion, and the answer of Huyghens affirming that he formerly pointed out to the late M. Pascal the error into which he had fallen. The close approach of these four letters, which cannot have been forged, leave not the least doubt as to the communications made by Pascal to Newton. The same relations between these two great geniuses is still more evident from the very curious and extraordinary series of letters, or projects of letters exchanged between Newton, James II., and Louis XIV. We again repeat that the mass of proofs in the possession of M. Chasles is so overwhelming that we are forced to yield before the evidence.

M. Coste read also a letter in which Sir David Brewster, to whom M. Chasles had sent four of MS. notes of Newton, gave an account of the comparisons made by the Earl of Portsmouth, the Earl of Macclesfield, and Sir Frederick Madden, between these notes and authenticated letters and signatures of Sir Isaac Newton. The conclusion of this examination shows that not only were the letters forgeries, but that the forger could never have seen the writing or signature of Newton otherwise than in the general Dictionary, or in the Macclesfield correspondence published in 1841. M. de Khanikof, as ocular witness of one of these comparisons, had reported to M. Chasles that the cause of this judgment was principally owing to the permanent difference between the *c* and the *n* of the notes from those in the authentic documents; now, in searching anew in the immense collection of M. Chasles, he found notes in which the *e* and *n* were the same as those in the English MSS., and others in which the same letters have a different form in the English documents, and in the French notes placed by M. Chasles in the hands of Sir David Brewster; the two forms are also found in a Latin letter of Newton, of which Father Secchi has brought a fac-simile from Geneva. In fine, the handwriting of a man varies with time; the differences between the writing of the same hand corresponding turn by turn in English, French, German, and Latin are sufficient to account for all the differences pointed out by the friends of Sir D. Brewster, and remove any serious objections raised by these comparisons. The fact that Newton had four or five different signatures, faithfully found in the notes of M. Chasles, and the extremity, to which Sir David Brewster is reduced, of pretending that the forgeries are recent and posterior to 1841, when speaking of the documents

from the collection of M. Desmaizeau, are powerful arguments in favour of the authenticity of the autographs of M. Chasles.

M. Dumas communicated a curious note, by which M. de Luca determined in the liquid contained in living mollusca the presence of a thirtieth part, or about 3 per cent of pure sulphuric acid; and stated also, that the same mollusca plunged in water disengages a considerable quantity of carbonic acid.

M. Dumas also laid on the table a work of great interest by Dr. Hofmann, on the transformation of wood-spirit into aldehyd, a problem which MM. Dumas and Peligot had vainly attempted to solve. Dr. Hofmann placed in a sufficiently long tube a spiral of platinum, which he raised to the temperature of incandescence by means of a voltaic current, then he traversed the tube by a continuous jet of the vapour of wood-spirit; this vapour is sufficiently heated to be decomposed, and transformed into aldehyd, which can be collected in the form of a continued stream; the operation can be continued for several days, and it has been proved that more than two-thirds of the wood-spirit is converted into aldehyd.

M. Dumas resumed the very original experiments made by M. Melsens on projectiles. By causing a leaden ball to fall into water from the height of about a mètre, he found that the ball drew along with it twenty times its volume of air. This same ball projected several mètres, by powder, to the interior of a cylinder, filled with water, the two vertical openings of which are shut by diaphragms of plaster, introduced into the cylinder nearly a hundred times its volume of air. If the initial velocity is small, the hole is about the same size as the ball (11 millimètres); by increasing the velocity it is much enlarged in size, and when considerably increased the hole becomes enormous. It is impossible to assign the cause of the increase of the hole to the ball alone. Also, when the velocity of projection is excessive, there is a double border inside and outside formed round the holes where the ball enters and quits.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, Oct. 2, 1867.

Formation of Volcanic Sal-ammoniac.—Power of the light of the electric spark to penetrate space.—Solar radiation at high elevations.

M. Angiolo Raniere has presented a memoir to the Academy of Sciences relative to the martial sal-ammoniac collected on the lava of Vesuvius during the eruption of 1850, starting from the region known by the name of the *Atrio del Cavallo*, as far as the south-east of the actual crater.

For a long time past naturalists have been divided upon the question of the origin of the sal-ammoniac disengaged by the fumes of volcanic lava. (*See third series of the "Annales de Chimie et de Physique*, 1853," pp. 289 & 292). Some admit that the hydrochloric acid, escaping from lava in motion, united to the iron which enters into their composition, formed a perchloride of iron, which, joined to the ammonia of the atmosphere, and to the excess of hydrochloric acid of these same lavas, would give rise to this mixture, of simple ammoniacal salt, and perchloride of iron, collected in the fissures.

This opinion does not agree with facts observed by M. Raniere during the flow of the lava at the eruption of Vesuvius in 1850. He observed that no fumes existed except where the lava had invaded a cultivated and manured territory; also that these fumes were in such abundanc that they gave more than 10,000 kilogrammes of salt of ammonia,* while, at another spot where the igneous current had taken its direction over the lava of 1834,† which was nothing but a rocky and sandy mass, there were found no salts of ammonia.

This fact demonstrates clearly that the ammoniacal salt proceeds from the decomposition of organic substances contained in the ground invaded by the lava, which effects, at a great heat, a sort of distillation, during which carbonate of ammonia is disengaged, to be converted into sal-ammoniac by the action of hydrochloric acid. We shall speak of the origin of this latter presently.

After the extreme intensity of heat has fused the silicic acid of this lava it acts on the silex of the lands surrounding Vesuvius. These latter are in a great portion formed of quartz, sand, and pouzzolana; and in the same manner as quartz acts in the preparation of phosphorus. by the process of Wöhler, the silex reacts on the sea-salt of these lands, as well as on other chlorides which they contain, and gives rise to muriatic acid, and to chloride of iron, with the hydrate of the sesquioxide of iron contained in the ground. Both of these products being volatile at this very elevated temperature, the result is that they acquire an extraordinary expansive force, and when the lava is yet soft they make their way through the mass, and compose what is called "fumerolles." From this gas emanates an aqueous vapour and a mixture of perchloride of iron, chloride of ammonium, sulphurous acid, sulphuretted hydrogen, &c. This lasts as long as the lava is not quite cold.

Mr. Felix Lucas, concludes from very original theroetic considerations, that the luminous distance at which the electric spark is visible is greater than that of a permanent light the apparent intensity of which would equal 250,000 times that of the spark. The light actually employed to illuminate our new lighthouses gives a brilliancy equal to 125 carcel lamps. An electric spark possessing the illuminating power of the 200th part only of a carcel burner, is superior as to its power of projecting light. Hence we can conceive the immense effect of a warning light composed of intermittent flashes of the electric spark proceeding from a strong Leyden jar battery. M. Lucas states that, in an experiment made in a laboratory, two apparatuses were established, one voltaic equal to 125 carcel lamps, and another spark-battery equivalent to only the 1-2000th part of a carcel wick. The photometer (such as is employed in the lighthouse administration) showed a marked superiority in favour of the spark.

Actinometric experiments made with the greatest care, at Geneva, on the glacier des Bossons and on the summit of Mont Blanc by M. Sorel, have led him to the following conclusions:—The increase of the radiation in proportion as the altitude is less rapid than the diminution of the barometric pressure, or than the diminution of the atmospheric thickness. This result is contrary to what can be deduced from the observations made by Mr. Forbes, in 1832, on the Faulhorn, and the Brientz, (*Phil. Trans.* 1842, part ii, p. 225). The atmospheric pressure being the same, the radiation observed at an elevated altitude is incontestably more powerful than at a lower altitude.

The ratio of the intensity of the solar radiation on Mont Blanc and Geneva is as about 6 to 5. Thus the solar heat which has arrived as far as 4,800 mètres above the superior strata of the atmosphere, is subject to an absorption of $\frac{1}{6}$, in traversing at an angle of 60° to 65°, the lower strata of the air at an altitude of 400 mètres.

F. Moigno.

* Antonio de Napoli, dealer in chemical products at Naples, bought more than a hundred quintals, and he has still twenty quintals left. Many other speculators have followed his example.

† This lava destroyed a whole well populated district of more than two hundred dwellings in the commune of Ottagano, at a spot called Tersigno. It furnished also several hundred quintals of salts of ammonia. M. Raniere is of opinion—and his theory is in perfect harmony with facts—that the muriatic acid proceeds from either rock-salt in the ground or from the infiltration of sea-water.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Tyrosin, derivatives of.—G. Beyer. Tyrosin was obtained by boiling one part of horn turnings with two of sulphuric acid and ten of water; the liquid was neutralised with calcic hydrate, filtered, and evaporated to half its original bulk. The calcium-compound of tyrosin was then converted into the corresponding lead-compound; this decomposed by sulphuretted hydrogen and the solution evaporated to crystallisation. It was converted into the nitrate, and then, according to Städeler's method, into nitrotyrosin. This nitro-compound is reduced to amidotyrosin, $C_9H_{12}N_2O_3$, by the action of tin and chlorhydric acid. The amido-compound is very deliquescent, but may be obtained as a crystalline powder by concentrating its aqueous solution at 100°, and cooling under the dessicator in a vacuum. It is anhydrous, sparingly soluble in hot alcohol, and is not decomposed when heated to 100°. It dissolves readily in diluted acids, forming well defined salts. Of these the hydrochlorate $C_9H_{12}N_2O_3$, $2HCl+H_2O$—two sulphates $C_9H_{12}N_2O_3$, $2H_2SO_4$, and $C_9H_{12}N_2O_3$, H_2SO_4—and a double sulphate of amidotyrosin and zinc, $Zn,SO_4+2(C_9H_{12}N_2O_3,H_2SO_4)$ are described.—(*Arch. Pharm.* [2] 130 44.)

Lecture Experiment.—A. Baeyer. When a glass rod, moistened with chlorhydric acid, is plunged into a flask, containing a few drops of an alcoholic solution of propargylic ethide $C_2H_3.O.C_2H_5$, thick, white clouds, like sal-ammoniac, are formed, This phenomenon evidently consists of an addition of ClH to the ether; by which the compound $C_3H_4Cl.O.C_2H_5$ is formed, and may serve as an illustration of the similarity which exists between non-saturated carbon-compounds and ammonia.—(*Ann. Chem. Pharm.* cxlii. 326.)

Oxysulphobenzid.—L. Glutz. It is still a matter of uncertainty whether phenol is to be considered as the hydrate of phenylic oxide $C_{12}H_5O.HO$, or as oxybenzol $C_{12}H_5O_2.H$. Supposing the latter to be the correct view, the action of sulphuric acid upon phenol will give rise to the formation of an oxysulphobenzid

$$\left.\begin{matrix}C_{12}H_5O_2\\C_{12}H_5O_2\end{matrix}\right\}[S_2O_4]$$

corresponding to the sulphobenzid

$$\left.\begin{matrix}C_{12}H_5\\C_{12}H_5\end{matrix}\right\}[S_2O_4]$$

from benzol. This reaction does indeed take place when two parts of phenol and three of sulphuric acid are heated together to 160°—170°. Oxysulphobenzid is sparingly soluble in cold water, readily in hot water, alcohol and ether. It has the properties of a weak acid; when dissolved in ammonic hydrate, and left to evaporate at ordinary temperatures, the compound

$$\left.\begin{matrix}C_{12}\left\{\begin{matrix}H_4\\H_4N\end{matrix}\right\}O_2\\C_{12}H_5O_2\end{matrix}\right\}[S_2O_4]$$

crystallises out. Nitric acid converts it into nitro-oxysulphobenzid

$$\left.\begin{matrix}C_{12}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}O_2\\C_{12}\left\{\begin{matrix}H_4\\NO_4\end{matrix}\right\}O_2\end{matrix}\right\}[S_2O_4]$$

which is insoluble in cold, sparingly soluble in hot water, soluble in alcohol. Strong sulphuric acid dissolves oxysulphobenzid at the ordinary temperature without decomposing it; when heated, decomposition takes place, in course of which oxyphenylsulphuric acid is formed. —(*Zeitschr. Chem.*, N. F. iii. 435.)

Mercuric Sulphocyanides.—T. Philipp. The white precipitate which is formed by adding potassic sulphocyanide to mercuric nitrate, and which is soluble in an excess of either salt, is mercuric sulphocyanide, $HgCy_2S$. Potasso-mercuric sulphocyanide, $HgCy_2S_2+KCyS$, is formed when mercuric nitrate is added to potassic sulphocyanide until the originally white precipitate is converted into a yellowish crystalline mass. The double-salt of mercuric cyanide and potassic sulphocyanide, $HgCy_2+KCyS+2aq.$ is obtained by mixing solutions of its two constituents together. Compounds of mercuric iodide, bromide, and chloride with potassic sulphocyanide may be obtained in a similar manner. The basic mercuric sulphocyanide of Claus, which is formed by adding ammonia to potasso-mercuric sulphocyanide, has the composition,

$$N\left\{\begin{matrix}H_2\\H\end{matrix}\right.CyS,HgO$$

(*Pogg. Ann.* cxxxi. 86.)

Oxyphenylendisulphonic Acid.—C. Weinhold. This acid is obtained, besides phenol sulphuric acid, from phenol by the action of sulphuric acid. The author prepares it in the following manner: sulphuric anhydride is distilled into a well cooled flask containing crystallised phenol; the reaction which thus takes place with moderate energy is completed by exposing the contents of the flask to the temperature of the water-bath for a couple of hours. The mixture is then diluted with water, and the new acid separated from the excess of sulphuric acid by fractional precipitation with plumbic carbonate. The solution of the neutral lead-salt is readily decomposed into a soluble acid and difficultly soluble basic salt; and by adding further quantities of plumbic carbonate, the whole may be converted into the basic salt, and thus be freed from phenol sulphuric acid which remains in solution. The oxyphenylendisulphonic acid is now isolated by means of sulphuric acid and sulphuretted hydrogen. It is a dibasic acid; its composition is:

$$2HO(C_{12}H_4O_2)''\left(\begin{matrix}S_2O_4\\S_2O_4\end{matrix}\right)O_2$$

It is readily soluble in water and alcohol, and with difficulty obtained in crystals. Its salts, with the exception of the basic lead salt, are also very soluble in water and alcohol.—(*Ann. Chem. Pharm.* cxliii. 58.)

CORRESPONDENCE.

THE SODA TRADE.

To the Editor of the Chemical News.

SIR,—I beg here to offer some remarks on Mr. Wright's paper in your last impression. He complains of the trade use which retains the old equivalent (24) for sodium, and it can certainly not be denied that it would be far better if the right equivalent (23) were taken instead. But I must protest against Mr. Wright's calling this well-known practice "a barefaced fraud." The facts of the case are known to most or all important buyers of soda-ash, and all bargains are made on the express condition of going by the analysis of some analytical chemist who may or may not take 24 as equivalent for Na, but will take 24 in most cases. The choice of the analytical chemist is practically always in the hands of the buyer. Does Mr. Wright really mean to impute a "barefaced fraud" to the great majority, if not to the whole, of the chemical manufac-

turers in this country? Besides, would they on their side submit to the equivalent 44 for peroxide of manganese if they considered it a "barefaced fraud," and not a custom of the trade which is understood by buyer and seller?

Mr. Wright further supposes that for the estimation of chloride of lime the iron process is the one generally used, and he asserts that all its known sources of inaccuracy tend to heighten the apparent percentage of chlorine. But he overlooks two important sources of possible errors, viz., the efflorescence of the ferrous salt and the escape of chlorine during the operation, the latter of which can hardly be totally avoided, and both of which lower the apparent percentage. It is, consequently, generally assumed that the iron process shows a little lower percentage (say 1 per cent) of available chlorine than the arsenite of soda process, and the latter, far more reliable one, is rightly superseding the former more and more in the laboratories.—I am, &c., A Practical Chemist.

MISCELLANEOUS.

The Newton-Pascal Forgeries.—Dr. T. Archer Hirst, F.R.S., writes to *The Times* as follows:—

Sir,—In a communication to the British Association at Dundee, I stated that M. Chasles, desirous of submitting his newly acquired papers to every possible test, had forwarded specimens of the alleged handwriting of Newton to Sir David Brewster and myself through his friend M. de Khanikof. Sir David Brewster has since submitted five of these specimens to the inspection of the Earl of Portsmouth, the Earl of Macclesfield, and Sir Frederic Madden, and the unanimous verdict of these authorities, as recorded in the *Athenæum* of September 28, is "that the handwriting is not that of Newton."

On Thursday last, M. de Khanikof accompanied me to Burlington House for the purpose of further comparing these specimens with the authentic letters of Newton in the possession of the Royal Society. We were assisted in our investigations by Dr. Sharpey, and the result was perfectly conclusive,—in short, entirely in accordance with the verdict above quoted. We also searched for evidence of a more positive nature touching the origin of these documents, and were rewarded with success. Without troubling you with the details of this new investigation, I may state that our efforts were first directed towards obtaining further information relative to the Pierre Desmaizeaux whose name so frequently appears in M. Chasles' documents. We found that at the commencement of the 18th century this gentleman resided in London; that on the 3rd of November, 1720, he was admitted a Fellow of the Royal Society by Sir Isaac Newton, then president; and that shortly before his election he had presented to the Society a copy of his new work, entitled, *Recueil de diverses Piéces sur la Philosophie, la Religion, &c., par MM. Leibnitz, Clarke, Newton, &c.* (Amsterdam, 1720.) On turning over the pages of the second volume of this work Mr. Walter White (assistant secretary to the Royal Society) had the good fortune to discover that three out of the five of the alleged specimens of Newton's handwriting were *verbatim* copies of isolated passages occurring in the French translation of three letters originally written by Newton in English. To each passage thus extracted the forger had appended Newton's name as a signature.

Without further comment on this annihilating fact, I pass to a more astounding one. Here is an exact copy of a fourth document alleged to have been written by Newton:—

"La realité de l'espace n'est pas une simple supposition; elle a esté prouvée par les argumens que j'ay rapportez, auxquels on n'a point repondu. On n'a point repondu non plus à un autre argument; savoir; que, l'espace et le temps sont des quantitez, ce qu'on ne peut dire de la situation et de l'ordre. "I NEWTON."

Newton is here made to copy and sign a garbled translation of a passage to the authorship of which even he has not the slightest claim; The real author is the well-known Dr. Samuel Clarke, rector of St. James, Westminster, between whom and Leibnitz a celebrated discussion on the principles of natural philosophy and religion was conducted by letters in 1715-17. In 1717 Dr. Clarke, after having had Leibnitz's letters carefully translated from French into English, and his own from English into French, published the whole correspondence in duplicate. From a copy of this work now in the British Museum I extract the following paragraph in Dr. Clarke's fourth reply to Leibnitz:—

Page 134.	Page 135.
"Sec. 14. La realité de l'espace n'est pas une simple supposition; elle a été prouvée par les arguments rapportez ci-dessus, auxquels on n'a point répondu. L'Auteur n'a pas répondu non plus a un autre argument, sçavoir, que l'espace et le temps sont des quantitez; ce qu'on ne peut dire de la situation et de l'ordre."	"Sec. 14. The reality of space is not a supposition, but is proved by the foregoing arguments, to which no answer has been given. Nor is any answer given to that other argument, that space and time are quantities, which situation and order are not."

It will be observed that in copying the passage on the left—not from Dr. Carke's work, but from Desmaizeaux's *Recueil*, where the French addition *only* of the correspondence was re-published,—the forger has, in one or two places, slightly departed from the original text. His motive for so doing has obviously been to render the extract somewhat less unsuited to the illustrious name he had the audacity to append thereto.

M. Chasles, whose disinterested integrity as a historian is beyond question, has hitherto declined to admit the possibility of the fabrication of the numerous documents in his possession. "Un faussaire," he has urged, "qui aurait fabriqué toutes ces lettres, toutes ces piéces, pour prouver qu'il a existé des relations entre Pascal et Newton, aurait eu bien du talent, puisqu'il aurait fait tout à la fois du Pascal, du Newton, du Montesquieu, du Leibnitz," &c. We know, at all events, in what manner this *faussaire a fait du Newton* without the expenditure of any talent whatever; and, knowing this, we cannot but regard the entire collection of documents as wholly untrustworthy—as wholly unworthy, indeed, of the further patronage of the eminent author of the *Aperçu Historique*.

Technical Education.—The following is a brief outline of the provision made by law in the Netherlands, in order to secure proper technical education for all classes of society. Section 12 of the law, which came into operation on the 1st or July, 1863, sanctions and orders the establishment of the following four descriptions of schools, viz. *a*, schools destined for the education of the ordinary artisans, and labourers, and agricultural labourers; *b*, in a higher class of schools; these are divided into such with three years and five years' course of instruction; *c*. agricultural colleges; *d*. a polytechnic school. Now Holland has always been a country where public instruction has ranked very high, as it does yet. The general government has established fifteen of the schools alluded to *sub. b.*, five of which are with a five years' course of instruction. Moreover, the municipal authorities of all larger towns have established schools as specified *sub. b.* Besides these schools there are in Holland three Athenæa established at Amsterdam, Deventer, and Maastricht, these being schools whereat in addition to physical science, also law, medicine, and literature are taught; no degrees however are granted at the Athenæa; besides these there are three universities, while there are distinct schools for educating officers of the army and

navy. The whole number of inhabitants of the Kingdom of the Netherlands in Europe is a little over three millions, and the occupation is chiefly agricultural and mercantile, rather than industrial. The law of 1863 on middle class and technical education was made after the lower class education had been thoroughly revised. There are several private middle class schools which have modified their programme in accordance with the law alluded to.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Le Génie Industriel. June, 1867.

F. L. Roux, "A Method of Preserving Armour Plated and other Iron Vessels by means of Copper Sheathing." Brissonneau, "New Apparatus for the Manufacture of Sugar." E. Grisdale, "A new Apparatus for Washing Photographic Proofs."

Comptes Rendus. July 8, 1867.

Becquerel, "Third Memoir on some newly-discovered Chemical Effects of Capillary Action." Daubree, "On the Classification adopted by the Paris Museum for the Collection of Meteorites." Secchi, "On the Nebula of Orion." N. Zinin, "On Benzoin and its Derivatives." Reboul and Truchot, "Researches on the Isomerism of the Acctylene Series." T. Hiortdahl, "On Protosulphide of Cobalt."

July 15.

Chasles, "Note on the Discovery of the Laws of Attraction by Pascal." Sorel, "Note on a new Cement made by slaking Magnesia with a solution of Chloride of Magnesium." J. Nickles, "On Fluomanganous Acid and other new Manganese Compounds." Lecoq de Boisbaudran, "Experiments on Supersaturation." Balbiani, "On a simple Method of Detecting the Presence of Corpuscles on Silk Worms."

July 22.

Duhamel, "Note on Pascal's Correspondence relating to the Laws of Attraction." Faye, "Note on Pascal's Correspondence relating to the Laws of Attraction." Chevreul, "Note on Pascal's Correspondence relation to the Laws of Attraction." Chasles, "Note on Pascal's Correspondence relating to the Laws of Attraction." Chevreul, "Report of the Author's Lectures on Chemistry delivered at the Museum of Natural History." Daubree, "Contributions to the Knowledge of the Structure of Meteorites." C. Matteucci, "On the Secondary Electro-motive power of the Nerves, and its Application to Physiology." Zaliwsky-Mikorski. "Note on a New Syphon." G. Grimaud de Caux, "A Comparative Study of the Results of the Removal of the Sewage Waters of Paris, Vienna, London, Marseilles, and Venice. J. Raynaud, "On a Practical Method of Determining the Voltaic Constants of a Battery." G. Lechartier, "On the Reproduction of Mimetese and of some Cloro-arseniates." Bizio. "Some new Researches on Glycogen." Phipson, "Note on a Simple Method of Detecting Iodine in the Presence of Bromine."

July 29.

Chasles, "Some further Communications relative to Pascal's Letters on the Laws of Attraction." Duhamel, "Some further Communications relative to Pascal's Letters on the Laws of Attraction." C. Matteucci, "On the Secondary Electromotive Force of the Nerves, and its Application to Physiology." H. Scoutetten, "On some Surgical Instruments found at Herculaneum and Pompeii." Faugere, "On the Pascal Correspondence." Benard, "On the Pascal Correspondence." P. Blaserna, "On the Duration of Induction Currents." R. D. Silva, "On Titaniferous Iron Sand from Santiago, Cape de Verd Islands." E. Grimaux, "On the Nitro derivates of the Benzylic Ethers." V. De Luynes and A. Lionet, "On the Methylic, Ethylic, and Amylic Derivatives of Orcin." Chevreul, "Remarks on J. Lemaire's Experiments on the Properties of Phenic Acid."

NOTES AND QUERIES.

Scarlet Ink. — Can any reader of the Chemical News put me in the way to make a scarlet ink, to write scarlet on blue paper with a steel pen?—B. W.

Detection of Sulphur in Petroleum.—Is there an easy test for the presence of sulphur in refined petroleum? I find a difficulty in knowing when it is sufficiently refined, as I have no ready test for this objectionable impurity.—Refiner.

Preserving Fresh Flowers.—I shall be greatly obliged if any of your courteous readers will kindly tell me how I can preserve cut flowers in a room. I remember reading somewhere that, adding some chemical substance to the water, would cause them to keep fresh for a week or more, but I have forgotten the name of the chemical.—Emily D.

Clarifying Oxymels.—Can any of your readers inform me of the plan generally adopted by pharmaceutists for clarifying oxymels?—Scilla Maritimas.

Succinic Acid.—Is the following reaction of succinic acid known? It has puzzled me considerably, and, before I found out the cause, led me into some mistakes. I have been in the habit of using succinic acid as a means of separating iron from solutions in quantitative analysis. A few weeks ago I was surprised to find that no precipitate was produced under circumstances in which I fully expected to see one, as I knew there was a ferric salt in solution. The solution was almost neutral, and I had added succinate of potash, but no precipitate of succinate of iron took place. After many experiments to ascertain the cause, I ascertained that the non-precipitation was owing to the presence of acetate of potash, which I had added in rather large quantity to get rid of free mineral acid. Following this up, I have ascertained that the presence of acetic acid, or a soluble acetate, partially or entirely suspends the ordinary reaction of succinic acid in solutions of ferric salts. Perhaps a note of this may prove useful to some of your readers, if inserted in your valuable "Notes and Queries" column.—J. Hooper.

German Yeast.—In reply to F. Ireland, a valued correspondent sends us the following information. The bulk of what is erroneously called in this country German yeast is made at Schiedam, Delftshaven, and Rotterdam. In a large cylindrical wooden vat, 1·15 meters high, and 1·6 meters diameter, a large quantity of tepid water is poured, and 180 kilogrammes of coarsely-ground rye and barley malt are added; this mixture is beaten into a thin paste, and the vat closed with a well-fitting lid; in order to prevent too rapid cooling, it is covered with a stout blanket, and left at rest for about two hours. At the end of this time the paste is diluted with very cold water, and thin distillers wash till perfectly fluid. Beer-yeast of good quality is now added in the proportion of half a kilogramme for every 2,000 litres of fluid; the whole is well stirred and left to settle. Fermentation soon commences, and after from five to seven hours the larger portion of the fluid is carefully drawn off from the sediment and collected in a tank; thence it is pumped into shallow wooden troughs placed under shelter and surrounded on all sides by louvre blinds. Each trough is 4 meters long, 2·75 broad, and 0·5 deep. The liquid shortly becomes very turbid, a thick mass, not unlike boiled starch, settles to the bottom, and the surface also becomes covered with a thick coherent cream-like scum; each of these deposits is the yeast; after 24 hours the intermediate fluid is withdrawn and returned to the original vat, whence it had been taken. The yeast is collected in bags made of strongly-woven linen canvass, and submitted to great pressure for 24 hours; it is then fit for use, and is exported as dry yeast. When one-third by weight of best barley malt and two-thirds of rye of good quality are used, and the operations carefully conducted, and when it is *not* intended to obtain spirits, the quantity of yeast may be very much increased. There is no truth in the assertion that such materials as chalk, bone-ash, plaster of Paris, French chalk, pipe-clay, &c., are used as adulterants. A small quantity of the best starch is, in the summer, sometimes mixed with the yeast. It makes it keep better in hot weather.

TO CORRESPONDENTS.

J. E. Wright.—For the purpose you name we recommend "Bloxam's Chemistry" published by Churchill. The price is not so high as you say you are willing to go to, but we presume that will be no objection.

A Subscriber from the commencement of the Chemical News.—The sign ∞ in mathematical language is the sign of infinity. Consult the article "Crystallography" in Watt's Dictionary.

W. E. Bickerdike.—Received with thanks. We believe a native hydrated ferric oxide is now used.

F. V.—The note arrived too late for insertion last week. The problem has now been solved. Accept our thanks for the same.

E. M. Delf.—We are sorry we cannot accede to our correspondent's request. The journal is not now in our possession. It can, however, be obtained through a foreign bookseller.

H. W. Tapper.—Will o' the Wisp paper is simply gun-paper, *i.e.* paper rendered explosive like gun-cotton. The flame may be coloured by soaking it in nitrate of baryta, strontia, &c.

Erratum.— In the report of Mr. Stanford's paper given in our last number, *for* chloride of iodine, *read* chloride of sodium.

Books Received. — The *Philosophical Magazine* for October.—*Scientific Review.*—"Second Report of the Quekett Microscopial Club."—Fourth Report of the British Association of Gas Managers, with Rules, Regulations and List of Members.—The *Shipwrecked Mariner* for July.— *Science Gossip*, for October.—The Calendar of the Pharmaceutical Society of Great Britain for 1867-68." *Popular Science Review*, for October.

Communications have been received from Lord Sackville Cecil; F. Rimington; E. M. Delf; Samuel Highley; Robert Hogg; Dr. Sansom (with enclosure); John Newlands; James Brown and Son; H. W. Tapper; Clayton and Co.; Dr. R. Oxland (with enclosure); William Baxter (with enclosure); R. Robertson (with enclosure) W. Bywater (with enclosure); J. Heywood; Samuel Sharpe; J. Blackburn; Dr. G. Lunge (with enclosure); F. Versmann; Maxwell Simpson F.R.S. (with two enclosures); W. Millar; L. Stokes (with enclosure); D. Forbes F.R.S. (with enclosure). E. C. C. Stanford; H. Dixon.

THE CHEMICAL NEWS.

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ON THE PROPERTY OF

TUNGSTIC AND SILICIC ACIDS TO COMBINE WITH PHOSPHORIC ACID,

AND THE PRESENCE OF THIS ACID IN OPAL, FLINT, QUARTZ, &c.

By WILLIAM SKEY,
Analyst to the Geological Survey of New Zealand.

In considering the behaviour of molybdic with phosphoric acid, it occurred to me whether other analogous phospho-compounds with the more insoluble mineral acids might not be made, or even have a present existence, but unrevealed, owing to the want of those decided colorific and physical changes which are involved in the production of phospho-molybdic acid from its individual compounds, and which in all probability led to the discovery of their mutual chemical affinities for each other. Many reasons for the possible existence of such compound presenting themselves, I began a course of experiments with tungstic acid, when it was soon ascertained most conclusively that this acid was able to effect a combination with phosphoric acid, in acid solutions. The compound so formed is void of colour even when boiled, whereas recently precipitated tungstic acid soon contracts a persistent yellow colour; under similar circumstances, the colour proper to the ignited acid.

Following up the subject, silica was next selected for examination, and the results thereof appearing to have some degree of interest, I would beg to state them here.

In the first place, a portion of quartz rock was pounded and fused with a mixture of carbonate and phosphate of soda, and subsequently treated in exactly the same manner as that described by Fresenius for the separation of silica. The insoluble residue from the hydrochloric acid was then thrown on a filter and washed until not a trace of phosphoric acid could be detected in the washings therefrom. A solution of pure ammonia was then passed through the residue on the filter, and to the filtrate ammonoi-chloride of magnesium was added, when a copious gelatinous precipitate appeared, which partly dissolved in acetic acid, and the filtered solution gave a considerable amount of a crystalline adhesive precipitate when rendered alkaline by ammonia: the part insoluble in the acid was silicate of magnesia. A portion of the crystalline precipitate above mentioned furnished yellow crystals when placed in contact with a solution of molybdic acid in nitric acid.

The capacity of silica to retain phosphoric acid in presence of water or hydrochloric acid being thus demonstrated, the possibility of the presence of phosphoric acid in certain of the more siliceous minerals naturally suggested itself; and forthwith I proceeded to examine some of these minerals, when I found unmistakeable indications of phosphoric acid. I also detected phosphoric acid in a specimen of flint, and in a portion of the quartz rock already treated of, but in quantity not nearly so large as when phosphate of soda was fused with it in the first experiment. I should state that in this instance, to get a fair comparison, the quartz was first fused with carbonate of soda, so that the whole of the phosphoric acid could be eliminated; but in the case of the other silicas, for the removal of their phosphoric acid for detection, I merely passed ammonia through their very finely ground powders. Subsequently, however, I obtained phosphoric acid from quartz by the same means.

As bearing upon the complete separation of phosphoric acid from granites, basalts, &c., I may further state that, as far as I have gone, I have invariably found phosphoric acid as a constituent of their silicas as separated for estimation. In one case I obtained ·16 per cent of phosphate of magnesia admixed with a small proportion of silicate of magnesia; but in the course of the laboratory work I hope to be able soon to furnish the absolute amount of phosphoric acid thus retained in those *silica residues* which come under my notice.

In conclusion, it would seem that the facts here recited tend to show—First—That the present mode of extracting phosphoric acid from siliceous minerals for estimation is radically wrong, or at least very imperfect, much of the phosphoric acid these minerals may contain being determined to their silica when recently precipitated, if not already in combination therewith. Secondly—That in the great majority of the analyses of silicates, &c., the silica therein is given a trifle too high; and, lastly—That phosphoric acid exists in larger quantity, and is even more widely distributed through the mineral kingdom than has hitherto been suspected—circumstances possessing some degree of interest in connection with both mineralogy and agriculture.

NOTICE OF

NATROBOROCALCITE IN NEW LOCALITIES,

AND OF OTHER BORATES IN HANTS COUNTY, NOVA SCOTIA.

By Professor HOW, Windsor, N.S.

In this journal, April 19th, 1867, I mentioned incidentally some facts respecting the occurrence of natroborocalcite here, and having lately found this mineral in the same matrix in new localities in this county, and also in its neighbourhood at one of these places, some other borates not before observed here, and (one at least) probably new, I offer a short note on the subject as possibly not uninteresting.

The revival of the trade in gypsum with the United States, which had declined very much during the late war, has caused great activity in the quarries of Nova Scotia, especially in this vicinity, which affords the greatest supply to that market. Not less than 70,000 tons of "plaster" have been cleared from this port during the 18 months ending June 30 of this year, the larger part of which has been shipped from the wharves of Windsor, having been brought from several quarries close at hand, or within some six miles. The rock exported consists principally of gypsum, the rest being anhydrite; both are called in the official returns gypsum, and locally, plaster, hard and soft respectively. An excellent opportunity is thus afforded here of studying the varieties of these rocks and the minerals they contain. In one of the heaps of "stones" brought from a quarry which had not been worked for twenty years until last season, I saw a specimen which I at once recognised as natroborocalcite, and, on examination, I found a considerable number of fine specimens, varying in size from that of a pea to that of a small hen's egg, embedded in gypsum, chiefly in a soft grey or "blue" variety, the colour of which rendered the snowy white borate very obvious. The rock was from near the surface of a quarry called Brookville, situated about three miles south of the original locality (mentioned in the paper in this journal above referred to), where the rocks dip gently to the south: low hills and a broad marsh lie between the two quarries. I afterwards observed the same mineral in gypsum from a quarry about six miles north-east of the original locality, but not in such abundance as at Brookville.

The Brookville quarry affords two other borates, one of which is a hydrated silicated borate of lime, apparently a new species. The observation of combined silica in more than traces in these beds for the first time is interesting. The other borate seems to be quite different from any before observed here, but I have not yet subjected it to analysis.

NOTE ON THE

PREPARATION OF CRYSTALLISED PHENIC ACID.

By W. E. BICKERDIKE, F.C.S.

IT is seldom that crystallised phenic acid can be obtained by the common process described for its preparation in the text books; and even when the crude liquid does crystallise, the still fluid portion contains the largest amount of the pure acid.

The following process I find always to give good results:—

The impure liquid separated from tar oils in the usual manner by means of soda solution, is first distilled alone, so as to get rid of most of the water and H_2S. It is then re-distilled in a perfectly dry retort with 1 to 2 per cent of anhydrous cupric sulphate, collecting the distillate in 5 or 6 dry flasks. Most of the distillate will crystallise at 16° C., though it is generally necessary to drop in a fragment of the solid.

If *much* H_2S is present, it should be removed by boiling, or by leaving the liquid in an open vessel, over night, previous to distilling with the sulphur.

Dalta Square, Lancaster, September 25th.

ON ULTRAMARINE.

By Dr. ERNST ROHRIG.

THE manufacture of artificial ultramarine is one of great interest, and has been the object of careful investigations by many eminent chemists during the last fifty years. But none of these investigations have shown the real cause of the colour of ultramarine, nor have they given a sufficient explanation of the chemical changes which the components undergo in its formation. This explanation would be the more interesting as it would supply some hints with regard to the nature of the colouring matter of many minerals, besides many chemical and metallurgical products.

It seems surprising to the writer that this manufacture has not been introduced into England, as the materials used in it are partially English, and the others could be obtained cheaper here than in Germany and France, where the manufacture is carried on to a great extent; and as furthermore the greatest trade and consumption of ultramarine takes place in England.

These facts will, perhaps, render the following communication acceptable to the readers of the CHEMICAL NEWS:

In former times ultramarine was produced from *lapis lazuli*, and being very rare had double the value of gold. The accidental formation of blue ultramarine-like masses in certain chemical processes (manufacture of soda) induced trials for the production of artificial ultramarine. Such trials by Guimet, in Toulouse, and Gmelin, in Tübingen, were crowned with success, almost simultaneously, though both investigations were carried on independently of each other.

Guimet has always kept his discovery a secret, but Gmelin* published his in 1828, and may, therefore, be considered the founder of the present ultramarine manufacture.

Both investigators have, no doubt, taken as the basis of their experiments the composition of the natural ultramarine from *lapis lazuli*. The composition of that ultramarine, according to Desormes and Clement†, is as follows:—

Silica	35·8
Alumina	34·8
Soda	23·2
Sulphur	3·1
Carbonate of lime	3·1

Some inferior sorts also contain iron.

Gmelin's mode of operation is the following:—

Solution of caustic soda is saturated with hydrated silica, and to this hydrated alumina, containing 90 per cent water, is added in such quantity that 35 parts of dry silica, will correspond to 30 parts of dry alumina. This mixture is evaporated to dryness. It is then mixed with some sulphur, pulverised and thoroughly mixed with an addition of dry carbonate of soda and flowers of sulphur. A quantity of each of the latter two substances is added equal in weight to the above dried mixture. This compound is pressed into a crucible, heated as quickly as possible, and kept at a red-heat for two hours. The resulting green-yellow mass is then heated in contact with air till it becomes blue. After this it is boiled out with water and well washed.

A number of different modes of producing ultramarine were afterwards published by chemical investigators.

Robiquet ‡ recommended a mixture of 2 parts china-clay, 3 sulphur, and 3 carbonate of soda.

Tiremon,§ 100 parts alumina or hydrated alumina, 1075 crystallised (or 400 dry) carbonate of soda, 221 sulphur, 3 sulphide of arsenic.

Prückner,‖ 200 parts sulphide of sodium (prepared by heating sulphate of soda with carbon and some sulphur), 50 clay as pure as possible, and 1 green copperas.

Brunner,¶ heated a mixture of 70 parts sand, 240 alum (the weight calculated for anhydrous alum), 48 carbon, 144 sulphur, and 240 carbonate of soda, in a closed crucible, at a low red-heat for about 1½ hours. The resulting mass, partly of a greenish hue, and partly of a reddish-yellow hue (and which was reduced to ⅗ths of its original volume) was washed. He obtained a light ash-grey powder, which he mixed with an equal weight of sulphur, and with 1½ times its weight of dry carbonate of and heated as before. This caused it to take a blueish-green hue. He then spread flowers of sulphur, until about $\frac{1}{12}$ of an inch in depth, upon an iron-plate, and on this a similar quantity of the last product, after having pulverised it. By heating the iron plate, he ignited the sulphur, taking care to keep the temperature as low as possible, avoiding heating the ultramarine to redness. After repeating such heating with sulphur 3—4 times, the ultramarine became of a fine dark blue colour. In this process it is necessary to remove the ultramarine from the plate, and to pulverise it afresh each time.

By roasting this ultramarine with sulphur it increases in weight from 5—10 per cent, and it is possible for it to increase still more if the heating is oftener repeated; however, the colour will not improve any more. If the ultramarine be heated without addition of sulphur, a decrease of weight takes place (probably as then sulphur becomes exchanged for oxygen), the ultramarine becomes paler and the powder more compact and granular.

According to *Gentele's* published method ultramarine is produced in manufactures from a mixture of clay with sulphate of soda and carbon; or with carbonate of soda, sulphur, and less carbon; and also with sulphate of soda, carbon, carbonate of soda, and sulphur. By heating these mixtures a green ultramarine would result, which by roasting with sulphur, in contact with air, would become blue.

*Ritter*** used for the production of ultramarine, a mixture of clay, sulphate of soda, and carbon.

He used china-clay from Cornwall, of the following composition.

Annales de Chemie lxvii. 317.

† *Naturwissenshaft. Abhdlngen. Wurtemberg.* ii., 191.

‡ *Annali de Pharm.*, x. 91.

§ *Comptes Rendus*, xiv. 761.

‖ *Dingl. Polyt. Journ.*, xciv. 388.

¶ *Poggend. Annalen*, lxvii. 541.

** *Ritter über des Ultram., Göttingen*, 1860.

Silica	47·06
Alumina	36·47
Peroxide of iron	1·10
Potash	3·16
Water	12·05
	99·84.

This mixture was roasted at a strong red-heat (900-950°); the result was raw ultramarine, white in colour, similar to that obtained by Brunner. This he called white ultramarine, as it is the first transformation of the alumina by the action of sulphide of sodium. This white compound, when exposed to atmospheric air at common temperatures, does not change, but if heated for some time at 100°, it slightly increases in weight, and if heated to 400° in free contact with air, it will take a dark yellow colour which changes to green on cooling. If the heating is continued for a longer period the Ultramarine will become blue. All the colours produced in this way are very pale, but they may be made much darker; the change takes place in a shorter time if sulphurous acid or chlorine is made to act at the same time, upon white ultramarine.

The components of the white ultramarine, as furnished by analysis, are the following:—

SiO_3	39·06
Al_2O_3	31·17
Na	17·75
K	1·33
Fe	0·07
a S	4·78
b S	1·42

a S is that which (according to Elsner and Breunlin) is evolved as sulphuretted hydrogen gas, and *b* S that sulphur which is retained in the residue.

The composition of the white ultramarine may be calculated as follows:—

$Si O_3$	39·06
Al_2O_3	31·17
Na O	14·75
K O	1·60
Na S	3·09
$Na S_2$	4·88
Fe S	0·11
	99·66

When this white compound is heated it becomes green and then blue, as one atom of S of the NaS_2 burns to sulphurous acid, causing the transformation of the colour.

As before stated, the addition of sulphur hastens the process of conversion. In one of Ritter's experiments, the quantity of extracted sulphur amounted to 1·3 per cent, and exactly the same quantity was contained in the NaO,SO_3 (1·32) formed. From this and from the proportion of SO_3 to the increase of weight it may be calculated that two equivalents, SO_2 combine with one equivalent, Na S forming NaO,SO_3+2S. It is singular that the sulphur of the NaS is not extracted, and that it combines with another portion of NaS of the ultramarine forming a higher sulphuret of sodium, while none of the sulphur existing as SO_2 is absorbed.

By calculating one equivalent oxygen for one equivalent of the sulphuric acid formed according to the first mentioned process:—

$$(Na_2S_2+S_2O_4-NaS_2+NaO,SO_3+S),$$

It will be found that the number calculated will express almost exactly the increase of weight found:—

Increase of weight .. 1·89 .. 4·49 .. 4·38 per cent.
SO_2+O .. .. .. 13·95 .. 4·44 .. 4·20 ,,

It is evident that sulphurous acid does not enter into the constitution of ultramarine, and acts only by abstracting some sodium from it.

According to Gentele's observation, chlorine will answer the same purpose; Ritter used it, and found it succeed perfectly well. As sulphurous acid only forms SO_2NaO, and Cl forms NaCl, omitting mention of a trace of ClS. From this it may be concluded, with perfect safety, that the sulphur is exclusively combined with sodium. If it were combined with Al and Si, MCl and SiO_3 would be found in the aqueous extract besides NaCl, which is not the case if dry chlorine free from hydrochloric acid is employed, and if the heat is not excessively high and of long duration. This fact also proves that the NaS in ultramarine exists in real chemical combination with the silicate; otherwise it would be completely decomposed by the action of chlorine. The silicate prevents the Na Cl from undergoing decomposition, and is able to combine with NaS.

The quantity of oxygen which is absorbed may be calculated from the proportion of the sulphuretted hydrogen gas evolved by acids from the blue ultramarine. By deducting the quantity of S, which is equivalent to the absorbed chlorine from the *a* S of the white ultramarine, the remainder will correspond to that quantity of sulphur which should be evolved by acids. And, as for each equivalent of O afterwards absorbed, one equivalent less will appear as sulphuretted hydrogen, the quantity of S in question may be calculated from the difference between that number and that which expresses the *a* S of the blue ultramarine. The real quantity will be equal to half the difference, as the equivalent of oxygen is half as large as that of sulphur.

Ritter found, by analysis, blue ultramarine to be composed of:—

	Silica	40·40 per cent.
	Alumina	31·88 ,,
	Soda	15·18 ,,
	Potash	1·65 ,,
Na 2·39 / S 5·55	Na S	7·94 ,,
	Hyposulphite of Soda	1·84 ,,
		98·89

The amount of sulphide of sodium and hyposulphite of soda is, of course, variable, and depends on the greater or less action of sulphurous acid or chlorine.

ON METEORS.*

By Professor ALEXANDER HERSCHEL.

(Continued from page 180.)

The progress of knowledge regarding shooting-stars may almost be identified with the history of the November star-shower. That great apparition which took Humboldt and Olmsted by surprise in 1799 and 1833, has met the gaze of thousands unable or unwilling to speculate upon its nature. Yet how aptly an Arabian chronicler of the last display describes the host of meteoric atoms invading the earth's atmosphere, as "the mighty armies of the sky joined in a fierce strife." He adds that the earth's atmosphere proved a perfect safeguard to ward off the skirmishers from the sphere of human habitations, for "the fire and sparks (he writes) were harmless, not touching the earth, or injuring our safety, as if night's daring horsemen, who continued till morning beating each other in single combat, gave us protection and peace." Thousands, again, who never saw the display of Humboldt, nor the much greater spectacle of Olmsted, have thought for themselves to penetrate its meaning. Humboldt, in his description of the star-shower at Cumana, states that the oldest inhabitants at Cumana remembered that a

* 1. *Dingl. Polytechn. Journal*, cxlii. 351.

* From a lecture delivered before the British Association, at Dundee.

similar phenomenon preceded the great earthquakes of 1766. But no suspicion of its periodicity could then have crossed his mind for want of a statement of the month and day. On the 13th of November, 1832, and again on the 13th of November, 1833, the shower reappeared, at first in Europe, and the second time in full magnificence in America. No doubt of its periodical character could, after that time, exist. A point of capital importance was also discovered on that occasion, which distinguished the great November star-shower from all other exhibitions of meteors that had been previously observed. Instead of clashing together, as too many old accounts of their appearance might, perhaps, lead us to imagine, the November meteors, in 1833, shot outwards in smoothly-flowing lines from a single centre of emanation in some part of the constellation Leo. Olmsted himself describes the radiant point of the star-shower as the vanishing point of nearly parallel straight lines seen in perspective. The position of the radiant point in Leo was by no means unanimously fixed by different observers. Olmsted thought it near the star γ Leonis, but Professor Twining placed it in the centre of Leo's sickle, close to the small star χ Leonis—the identical spot where observers agreed in placing it during the November star-shower in 1866. The fixity of this point among the stars was, in the opinion of Professor Twining, sufficiently distinct to enable him to recognise that at this juncture the earth passed through a vastly extended system of meteoric bodies entirely independent of every terrestrial agency, and yet moving in entire harmony and concert,—in short, that each November meteor had an orbit, and that in their orbits they were all revolving together round the sun. Humboldt described them a little later as pocket planets, and as such they continued to be considered until their expected return, after a lapse of about thirty-three years, should enable observers, with better means at their command, and with full preparation for their reappearance, to come to a more exact conclusion.

It was soon after this that Mr. Quetelet, of Brussels, formed a catalogue of all the ancient records of star-showers that he was able to collect, in order to discover in them any signs of a periodical character that might exist. He succeeded in predicting the return of the meteors of St. Lawrence on the 10th of August, 1837, which have ever since been the most constantly observed of star-showers. The radiant point of this shower is not far from the sword-handle of Perseus. The result showed that other periodical star-showers might probably be looked for with success, and one which took place at Richmond, U.S., on the 20th of April, 1803, was watched for by Hewick in America, and was found to resemble that which from time to time appears on the 2nd of January, by great uncertainty in its returns. Its radiant point he found to be near Vega Lyræ. The other date when meteors are supposed to be most plentiful is the 2nd of January, when the meteors have a radiant point near the right knee in the figure of the constellation Hercules. A moderate shower of meteors is seen every year on the night of the 12th of December, radiating from the neighbourhood of Castor and Pollux. Finally, on or about the 19th of October, a tolerably well-marked shower of meteors has been seen during the last two years radiating in a very definite manner from Orion.

It is an interesting discovery in the familiar phenomenon of shooting stars. perhaps too long neglected, as Mr Quetelet remarks, by astronomers, that if their number seen on any night, by one person, much exceeds fifteen per hour, the appearance generally indicates a special shower; and a very moderate amount of attention to their apparent tracks among the stars in general suffices to determine the fixed centre of radiation from which they diverge. A small degree of diligence and perseverance may thus often be profitably bestowed in rendering with very little trouble an essential service to astronomy, which would doubtless be more heeded if the beautifully striking property of shower-meteors to radiate from a fixed point among the constellations were more generally known. From the records of scattered observations, extending over more than twenty years, the Luminous Meteor Committee of the British Association believe that they have traced the existence of at least fifty periods of such occurrences during the twelve months of the year, with the positions of their connected radiant points. But the exact date of maximum of many of the showers is still undetermined, and this is what an opportunity might frequently present itself to observers of shower-meteors to supply.

A study of ancient appearances of the November meteors led Professor Newton, of Yale College, U.S.A, to anticipate their reappearance on the morning of the 14th of November last. The interest of astronomers was awakened by the seasonable appeal in good time for preparations to be made in almost every quarter of the globe to note the reappearance of the shower. The area of its visibility extended from the British Isles to India in the east; and from Europe in the northern to the Cape of Good Hope in the southern hemisphere. This was exactly the district occupied by the same shower at its appearance in the year 1832, and it may be expected that this great shower, like that of 1833, will this year be again visible in America on the morning of the 14th November next. In that case, it will be only partially visible in Europe; but it may include some of the most brilliant parts of the shower, so as not to allow of losing the opportunity of seeing what there is. The position of the radiant point, as well as the moment of the maximum abundance was distinguished with great precision at the Royal Observatory, Greenwich, and, compared with observations at other places, leave nothing to be desired in respect of philosophical exactness. The moment of maximum frequency, observed at the Cape of Good Hope Observatory, shows that South Africa, on account of its high southern latitude, entered the densest portion of the shower about fifteen minutes earlier than the same phase of shower was witnessed in the British Isles; while the total duration of the shower, at all the stations, shows that the greatest thickness of the stream of meteoric bodies through which the earth passed in two hours was about thirty thousand miles. The inclination of the stream to the earth's orbit was also determined, whilst, by a new consent of eminent master-minds—M. Le Verrier and Professor Adams—at the end of elaborate calculations, both agreed that the true orbit of the meteoric stream is a long ellipse extending from the earth's orbit at its least, to that of Uranus at its greatest distance from the sun. The periodic time of the meteors in their orbit is thirty-three years and a quarter. The inclination of the orbit to the plane of the elliptic is about seventeen degrees, and the meteors revolve round the sun in the opposite direction to the earth. It appears that the densest portion of the group has not yet been passed through, as it occupies such an extent of length along the elliptic orbit as to require two or three years to make its passage round the sun.

A most curious incident connected with these discoveries is, that a comet detected by Tempel shortly after the first outposts of the November meteors made their appearance in 1865, to which an elliptic orbit, with a period of thirty-three years and a quarter, was assigned by Oppolzer, before the recent display of the November meteors was observed, is found to move in exactly the same orbit with the meteoric bodies, throughout their entire revolution round the sun. A coincidence so unexpected, and against which the probablilities are *a priori* so enormous, must alone make the physical connection between Tempel's comet and the group of meteoric bodies little less than certain. But the astronomer of the Brera College of Milan, Signor Schiaparelli, had already published the announcement in a letter written previously to this discovery to the Padre Secchi, that the orbits of the St. Lawrence's meteors of the 10th of August, which he supposes to be nearly parabolic, must, in that

case, coincide almost exactly with the long ellipitic orbit of a very conspicuous comet, known as Swift's or Tuttle's comet, which appeared in August and September, 1862. A similar inquiry has since been made by Dr. Weisse regarding the orbit of the group of April shower-meteors, supposed, like the former, to be nearly parabolic; and this is found to coincide almost exactly with the long elliptic orbit of a bright comet which was visible for some weeks in the month of June of the year 1861.

Shower meteors thus continue to engage great attention, and by the light which their new-found relation to those most mysterious messengers from distant space, may end by throwing light upon the obscurity of the phenomena of comets.

The spectroscope has been turned with some success to analyse their light; and it was found by Mr. Huggins that the nucleus of Tempel's comet was self-luminous, shining with a single ray of bluish light; while the pale light of the envelope consisted of the sun's reflected rays. Spectroscopes of the best form that could be devised were turned towards the streaks of the November meteors; and in some of those was also recognised a single ray of a lavender blue, or of a greyish colour.

It is not impossible that the meteoric particles are portions of the comet's tails, shreds of a dismembered mist, torn by the sun's disturbing action from the nucleus of the comet, and left upon its path like embers or smoke-flakes in the track of an expiring flame. But is the heat of their collision with the atmosphere sufficient to restore a portion of the luminous appearance with which they shone in the nucleus of the comet? or are the November meteors and Tempel's comet perfect nebulæ undergoing condensation, of which the meteoric bodies are the quite-faded stars, and the cometary nucleus is the still gaseous and self-luminous portion of the nebula? When the bright and persistent character of the cometic portions of the November meteor streaks is borne in mind, the telescope armed with the spectroscope may still enter the field on the eventful morning of the 14th of November next. An answer will then, if possible, be given to questions which as yet hardly admit of being rightly framed, so unexpected are the revelations, and so novel are the conceptions which a few short months have introduced into the rapidly advancing theatre of meteoric astronomy. These observations are thus given, and it is to be hoped they may prove of some value in ascertaining the character of meteors and comets. When, on the next starry shower or appearance of November meteors, the telescope or stereoscope are presented to these bright streaks, we may thus hope that answers may be given to the questions which can as yet hardly be framed—for sudden are the conceptions which have in the few past months dawned upon us in this history of meteoric phenomena.

BRITISH PHARMACEUTICAL CONFERENCE.

FOURTH ANNUAL MEEIING, AT DUNDEE.

President—PROFESSOR BENTLEY, F.L.S., M.R.C.S., &c.

(Continued from page 167.)

I. *Report on the Advantages or Disadvantages of the Employment in Pharmacy of Nitric Acid of Specific Gravity* 1·5.

II. *Report on the Nitro Hydrochloric Acid of the British Pharmacopœia, and the Changes in it on keeping.*

By W. E. Heathfield, F.C.S.

The inquiry proposed in reference to the first of these two subjects having been rendered supererogatory, in consequence of the change prescribed in the British Pharmacopœia, which has appeared since the announcement of these questions, I pass it over with the comment that it has been difficult to procure nitric acid uniformly of the gravity of 1·5; that it is very rarely free from a considerable quantity of nitrous acid, as evidenced when the acid is poured into water with a view to dilution; that it is uncertain in strength, from its tendency to decompose, and that it is inconvenient to pack, dangerous in transit, and unmanageable in use. The acid of the British Pharmacopœia of 1867 is doubtless an excellent substitute, containing, as it does, 70 per cent. of monohydrated acid, this water being combined with the acid as a base, whilst the accompanying 30 per cent are in such a state of combination as to be termed the constitutional water. It undergoes no change on keeping.

Referring to the second inquiry,—the nitro-hydrochloric acid, and the changes in it on keeping,—it is to be observed, that since the institution of these experiments, the British Pharmacopœia of 1867 has been presented, with an alteration in the formula and directions for the production of this acid, which yields the following results:—The specific gravity of the two acids, on admixture, and, after cooling, was 1·277, but on standing for 24 hours as directed, was 1·268. On adding the quantity of water for the production of the dilute acid, the specific gravity was found to be but 1·063, and 352·4 grains, or 6 fluid drachms, required but 840 measures of volumetric solution of soda for neutralization.

This experiment having been conducted with a view to determine the loss of hydrochloric acid consequent upon leaving the mixed acids for twenty-four hours, the operation was conducted so that on the mixture of the two acids in a loosely-stoppered bottle, the escaping chlorine should be collected under a bell-glass, and should be received into a solution of potassa. This solution, at the end of the twenty-four hours, was subjected to estimation by means of nitrate of silver, and was found to be charged with chlorine, which, calculated as hydrochloric acid, was found to be in such a proportion as to have diminished the strength of the nitro-hydrochloric acid by about 3 per cent. The loss of nitric acid was not estimated.

Proceeding somewhat differently, with a view to the production of dilute nitro-hydrochloric acid, the following process was adopted:—The proportions of acids ordered in the Pharmacopœia of 1867 were united, and, on cooling, the specific gravity was 1·277. The water was then added, and the specific gravity was 1·074, thus corresponding to the theoretic gravity of the Pharmacopœia of 1864. 352·4 grains required 1,000 measures of volumetric solution of soda. This experiment was made on the 31st of May, and the tests were again applied on the 29th of August, when no variation had taken place, thus proving that the diluted acid was not impaired by keeping for a moderate length of time.

Whatever may be the estimation in which the process for the production of diluted nitro-hydrochloric acid is held, it is clear that it can scarcely attain the result desired, viz., uniformity. If the acids are mixed as directed, there must necessarily be loss, for it is not easy to imprison the escaping vapours, and an explosion would be likely to occur in a bottle well stoppered; in one not so, as directed, the escape of vapours is considerable, as indicated by the experiments detailed in this paper.

"*Notes on Tinctura Opii and Liq. Opii Sedativus.*"

By Mr. Alfred Southall, Birmingham.

In continuation of a subject which was brought forward at the last meeting of the Conference, viz., the analysis of various specimens of ordinary commercial opium; in order, further, to show the extremely uncertain medicinal value of different samples, I have since examined a variety of specimens of tincture of opium, some of which have been kindly forwarded to me by Dr. Attfield. These specimens were, I believe, procured indiscriminately from the establishments of various pharmaceutists, and show a variation in strength which may well rather alarm the prescriber for the welfare of his patient.

Taking the standard of strength required by the British Pharmacopœia, which states that 100 grains of opium should yield at least 6 to 8 per cent of morphia, the consequent strength of tincture of opium, B.P., should be not less than 0·5 per cent of morphia. The following is my result of nine samples of tincture :—

No. 1	specimen	contained	0·3	per cent	of morphia.
,, 2	,,	,,	0·5	,,	,,
,, 3	,,	,,	0·6	,,	,,
,, 4	,,	,,	0·5	,,	,,
,, 5	,,	,,	0·2	,,	,,
,, 6	,,	,,	0·5	,,	,,
,, 7	,,	,,	0·4	,,	,,
,, 8	,,	,,	0·7	,,	,,
,, 9	,,	,,	0·5	,,	,,

Good commercial opium, such as is commonly found in the English market (as our analysis last year showed), contains frequently as much as 10 to 13 per cent of morphia; and the Pharmacopœia, laying no restriction upon a maximum yield of morphia, opens a wide door for a great diversity in the strength of its opium preparations, so that a tincture yielding from ½ to 1 per cent of morphia is within the Pharmacopœia limits.

Although liq. opii sedativus is not officinal, yet this form of administering opium is scarcely less important than the tincture. It is, however, interesting to notice in the analysis of the eight following samples, that the same wide diversity exists :—

No. 1	specimen	contains	0·6	per cent	of morphia.
,, 2	,,	,,	1·2	,,	,,
,, 3	,,	,,	0·7	,,	,,
,, 4	,,	,,	1·0	,,	,,
,, 5	,,	,,	0·5	,,	,,
,, 6	,,	,,	0·8	,,	,,
,, 7	,,	,,	1·5	,,	,,
,, 8	,,	,,	1·1	,,	,,

"*Remarks upon the Uses of Bisulphite of Lime in Pharmacy.*"

By Wentworth Lascelles Scott, F.C.S., &c.

I have undertaken to lay before the British Pharmaceutical Conference, in a few words, the results of some experiments instituted with the view of discovering a means of preventing the rancidity and decomposition to which various ointments and fatty preparations are liable, if kept for any length of time.

A series of specimens of freshly-made spermaceti and other ointments, cold cream, bear's grease, and simple lard, were placed in similar pots, and allowed to rest in a warm situation; a duplicate series, to which a very small proportion of bisulphite of lime had been added, being put by the side of the first.

In the course of six or seven months, most of the first series had become more or less decomposed; they had an acid reaction and disagreeable odour, while those to which the bisulphite had been added remained absolutely fresh and sweet. In consequence, I now treat all preparations of fatty or oleaginous substances with a little of this salt, applied in the form of strong solution, and have never yet found it to fail.

For ointments, a fluid drachm to each pound is quite sufficient to preserve them, while it has no injurious action whatever, and is quite compatible with the great majority of ointments and oily preparations,—a remark which does not apply to the alkaline sulphites or bisulphites which have from time to time been brought forward for similar purposes.

Beef-tea or broth in hospitals or otherwise may be prevented from turning sour by stirring in a few drops of the bisulphite of lime solution to each pint of the soup; and the same plan will enable us to keep jellies, which ordinarily decompose so rapidly in the organic germ-laden air of the sick-room, for many days unimpaired; these are, in my opinion, considerations of some moment in all circumstances, but most especially in the habitations of the poor.

Clothes or matting, soaked in the same solution and hung up, act as disinfectants of the most effective kind, and do not exhale the peculiarly unpleasant odour of carbolic acid, or the irritating vapours, so distressing to the bronchial system, of chloride of lime.

I have successfully employed the bisulphite of calcium for the preservation of numerous anatomical and other specimens, as it does its work perfectly, and without occasioning the great changes of colour and contraction of muscular structure so frequently produced by ordinary antiseptics; moreover, its special advantage over the preparations of mercury and arsenic lies, to my thinking, in the fact that it is not poisonous, and can therefore be handled with perfect safety.

There are numerous substances employed in pharmacy,—such as musk, castoreum, lard, and other fatty matters,—which are more or less injured by decomposition or keeping for any length of time. To these the bisulphite can be applied with considerable advantage.

Notes on the Use of the Microscope, and its Crystallographic Application.

By W. W. Stoddart.

After referring to the history of the microscope, the author spoke of it as a source of the greatest assistance in saving time, by indicating what the chemist afterwards verifies with his reagents.

The analytical chemist will tell you to the uttermost part of a fraction the proportion of C, H, O, Ca, K, &c., but he cannot tell in what state of combination they existed till the lens shows the granules of starch or the vegetable cell. The mineralogist would know that his tripoli was silica and alumina, but how could he possibly guess that it was composed of myriads of elegant and most beautifully-sculptured vegetable skeletons? So with the retail chemist; how (without the microscope) would he be able to tell that his wholesale brother had been putting bean-flour with his fænugreek, or lignum vitæ with his jalap?

A good example of the large amount of knowledge obtainable in a short time, and very commonly required from the dispensing chemist, is in the examination of urine or urinary deposit. We will suppose a clear example to be given with no apparent deposit. Evaporate and ignite a few drops on a bit of platinum foil. While this is going on put a drop of the secretion on a glass slip with a very little nitric acid, when in a few minutes crystals will appear, which under the microscope show the well-known rhomboids of *nitrate of urea*.

Examine another drop as it is under a quarter-inch lens, when *oxalate of lime*, epithelial scales, &c., may be detected. Now dissolve off the ash left on the foil with a drop or two of distilled water. Place a drop on two glass slips. To the one add the smallest quantity of ammonia, and dry. The lens will then show *phosphate of lime*, *triple phosphate*, and *chloride of sodium*. To the other drop add bichloride of platinum, and evaporate to dryness. If *soda* be present, you will have acicular crystals of the platinochloride; or if *potash* be there, you will find cubical crystals of the corresponding salt. Thus, in a few minutes, by the aid of the microscope, no less than seven distinct salts may be readily detected, besides a great number of others.

Few fluids can be found, whether natural or artificial, whether a secretion or a chemical solution, that do not contain substances which, by some means or other, may be made to separate as crystals. Now, as these crystalline attributes are so universal and constant, the author has founded on it his method of determining the name and nature of the crystalline constituents of a given

fluid,—a method by which, without any chemical test, but simply a microgoniometer, the name may be determined.

Crystals may be obtained from a given solution for microscopical purposes in six different ways, no matter how small the quantity may be:—

1. By simple deposition by cooling; as the well-known triple phosphate, so often seen in animal secretions.
2. By precipitating a salt in a comparatively insoluble form; as the sulphocyanide of strychnia or bitartrate of potash.
3. By fusion; as in the case of salicine and several of the alkaloids.
4. By galvanic deposition; as in the detection of lactic acid.
5. By sublimation; as in arsenious and benzoic acids, thein, &c.
6. By evaporation.

In all the previous methods the object usually is to obtain *separate* and characteristic crystals, whose natures are only to be known by their peculiar form or confirmative testing. By the mode now to be described the author has obtained certain results which, as they have not hitherto been published, he wishes now to lay before you, hoping that to some they may prove useful.

A drop of the given solution is placed on a glass slip, and slowly evaporated over the flame of the spirit-lamp, or in a drying chamber. A crystalline residue is left which, to the eye only, appears simply a magma of crystals without any definite arrangement. From a careful study of these, considerably magnified, the author noticed a certain arrangement of lines peculiar and constant to every salt. Again, on every slide it will be noticed that two angles always predominate over the others, and that the same salts have these two angles invariably the same. It is thought, therefore, that a table might be constructed from these angles, so that a measurement and reference to the table would give the name of the salt.

The goniometers used by the author are that made by Ross and that invented by Dr. Leeson; the latter being more correct, while the former is more easily used.

Ross's goniometer is a positive eye-piece, across the field of which is a very fine line, the whole being made to revolve in a circle very finely graduated. When used, the engraved line is placed over or parallel to one side of the angle to be measured. The line is then revolved by means of the rackwork till it coincides with the other side of the angle, when that portion of the graduated arc traversed by the vernier gives a very correct measurement of the angle required.

The beautiful instrument of Dr. Leeson is an ingenious application of the phenomena of double refraction. It is equally adapted for measuring opaque or transparent crystals, microscopic or the largest crystals. It consists of a double refracting prism of Iceland spar, which is mounted over the eye-piece, and the whole fitted into a very finely-divided circle. When, therefore, the crystal is viewed through this prism two angles are produced, which revolve round each other as the prism is revolved. The amount of rotation, when applied to the angle, gives the measurement required.

The author feels that he has not worked out the subject as it deserves; indeed, so much more work remains to be done, requiring more time than he has at his disposal, that having made public the *modus operandi*, he hopes some one will continue its development.

Table of Angles.

Name of Crystal.	Predominating Angles.	
Sulphate of magnesia	120° 4′	105°
Bicarbonate of potash	90°	128° 5′
Nitrate of potash	76° 30′	103° 30′
Ammonia alum	90°	120°
Tartaric acid	97° 10′	83° 30′
Oxalic acid	74° 2′	106° 8′
Cholesterine	79° 30	100° 30′

Mr. C. Kerr, of Dundee, read a paper on the interference of the excise in the sale of quinine wine, observing that something must be radically wrong, when chemists were made to pay license for making medicated wine with British wine, and not for making them with foreign wine; and now that quinine wine is a preparation of the British Pharmacopœia, he proposed that the Excise Board be communicated with on the subject.

INTRODUCTORY ADDRESS

DELIVERED AT

ST. BARTHOLOMEW'S HOSPITAL MEDICAL SCHOOL.*

SESSION 1867-68.

By WILLIAM ODLING, M.B. Lond., F.R.S.,
Lecturer on Chemistry at the Hospital.

I HAVE dwelt largely upon the importance of your acquiring the utmost attainable knowledge of disease, in order that you may be able hereafter to deal with disease. You are now for a few years, and must indeed continue to be all your lives, students of medicine, so as to become and continue practitioners of medicine. With you, as future practitioners, knowledge is only a means to an end, and that end the cure of disease. The medical man is a medical artist; and his ultimate object is, not to accumulate knowledge, but to multiply cures. As practitioners of medicine, then, you are called upon, not only to know, but to act. Now, as was so clearly pointed out last year, in almost every concern of life in which action has to be taken, we do not act with an absolute certainty, either of the state of affairs under which we act, or of the result that will follow our action, but upon a probability only, approximating more or less to the value of an absolute certainty in different cases. And, if we are judicious men, we are all the more cautious in acting in proportion to the importance of our act, and the inferior certainty of our knowledge. The practice of medicine, indeed, like that of any other art, may, in various ways, be good or bad, judicious or injudicious, skilful or unskilful; but, to act skilfully, it is above all things necessary for you to act with a well-founded and well-applied judgment, alike as to the conditions and consequences of your act. For this purpose, you must have an experience of cases on which to found your judgment of any particular case, and also an experience in the application of your judgment to the features of different cases. And this double experience by which you will be enabled to appreciate what is required, must be further supplemented by an experience in effecting what is required. Skill in ascertaining how matters stand, skill in perceiving what is desirable, and skill in effecting what you desire, can only be attained by constant practice in ascertaining, perceiving, and effecting. In other words, so as to express an obvious truism, for the skilful practice of medical art you must be practical men; not, indeed, as distinguished from scientific men—not as being unacquainted with the science of disease, but rather as having pursued your knowledge of that science to its most special developments, and familiarised yourselves with its most special applications. As practical men, having that prompt understanding of what is required to be done, and how to do it, which continuous practice alone can impart, you may, perhaps, have a something in addition to the merely scientific man, but assuredly nothing in contradistinction to him. Mentally, indeed, we may dissociate the science from the art of medicine; actually they are one and indivisible. Science is knowing; art is doing or practising; but it is quite impossible to

* Extract, communicated and corrected by the Author.

know the science without practising the art, or to practise the art without learning the science of medicine. Of course, the scientific man, though possessing a knowledge of all the sciences under the sun except the science of medicine, wanting the knowledge of that, can never be a physician. And the knowledge of medicine, like any other branch of natural history knowledge, can only be acquired by working at the subject of that knowledge—that is to say, by attending to the practice of medicine and the investigation of disease. For the successful practice of medicine, then, as for the practice of any other art, that particular kind of intimate personal knowledge which results from or constitutes personal experience, is most of all required; since the conditions affecting disease in any particular case are so various that nothing but experience will enable you to estimate them even approximately. . . . . .

And now, gentlemen, what has been the object of my address? It has been to satisfy you of the reality of medicine as a branch of human knowledge, and of the soundness of medical practice in so far as it is based upon knowledge and philanthropy. Every branch of human knowledge is necessarily incomplete, and very much in proportion to the complex and recondite character of the phenomena with which it concerns itself. As a consequence of its incompleteness, every branch of knowledge is more or less tinctured with error; and much unsuspected error doubtless prevails and will prevail in medicine. But the strength of our position is this, that we are desirous only for the establishment of truth. Our present views are merely the resultant of our present knowledge, and are held by us on the express tenure of changeability with greater certainty of knowledge. To acquire this greater certainty, our method is to consider, observe, and investigate phenomena; not, indeed, without an expectation of finding—not even without some unphilosophical wish to find—that the truth may lie in a particular direction; but still with the single-minded intention of learning what the fact of the matter is, and of loyally accepting it.

It is thus that our present knowledge of medicine has been established by the same method as the knowledge of every other branch of natural science; and many investigations in practical medicine will take their place amongst the finest examples of scientific work recorded. Allowing also for the different character of its subject, much of our knowledge with regard to disease will bear the most searching examination to which any branch of knowledge can be exposed; and there is no part of our professed knowledge that we fear to submit to the most rigorous ordeal, since we derive no less benefit from its refutation than its confirmation. As students of nature, we have no system of medicine to stand or fall by; for the physician, of all men in the world, is essentially *homo naturæ minister et interpres*, and nothing more. He no longer looks upon himself as the depository of some occult mystery, but as a mere student of nature; whose knowledge, indeed, so far as it goes, is a real knowledge, but who aspires to and incessantly strives for the attainment of more perfect knowledge.

The knowledge of diseases, however, is a plant of slow growth. You cannot complete the knowledge here; you can, indeed, do little more than lay the foundation for it; and the sounder and broader your foundation, the greater the degree to which you will hereafter be able to extend your knowledge. But to understand disease aright, as to understand every other phenomenon of nature, you must not only study the disease itself, but must also prepare yourselves for such study by the acquisition of extensive preliminary knowledge. It is most unfortunate that, from the defective state of physical education at schools and colleges, much of the preliminary knowledge which you ought already to possess, you will have to acquire here, whereby valuable time, which, in this home of disease, could be advantageously devoted to the work of your profession, will be seriously encroached upon; and, after all, you will not obtain such a knowledge of general science as you ought to possess, and which—in the forcible language of Prof. Huxley—you would possess "if those who regulate education in this country had a right conception of what their duties are, or of the purpose of education, and the conditions of the progress of mankind at the present time." By rights, I maintain, no one should be allowed to enter at a medical school without having a competent knowledge of the three great divisions of natural science—namely, physics, chemistry, and biology; whereby our distinct courses of comparative anatomy, of botany, and of general chemistry and physics, might be abolished from the curriculum of hospital study, as deriving no advantage from their association with hospital work. Chemistry, indeed, as the basis of vital dynamics and sheet-anchor of rational therapeutics, must ever form an important branch of medical education. But the sort of chemistry which should be taught—in our own chemical theatre, for instance, and in that magnificent laboratory which you, Sir, have lately had constructed—is very different from the chemistry which I am in the habit of teaching, and shall, I fear, long continue to teach. It should be an altogether special development of chemistry, having to the chemistry ordinarily taught much the same relation that the study of human anatomy and physiology has to the study of biology in general, and having a scarcely less direct bearing upon your strictly professional duties.

But you must make the best of circumstances as they exist, and endeavour, while here, to obtain as much preliminary science as you can. In your future careers you will necessarily have to compete with men far more experienced in disease than yourselves, and your only chance of competing with them successfully will consist in compensating as far as may be for their superior experience, by starting upon a surer foundation of medical knowledge than was possible to them at the outset of their careers. But all your preliminary knowledge must culminate in your acquiring an ultimate knowledge of disease, and the ultimate branch of your knowledge is just as scientific as the preliminary. If you content yourselves with laying the foundation—if you neglect to raise the superstructure,—you cannot be called physicians. In that case, and in that case only, will you be at a disadvantage with the so-called practical man, whose superstructure at any rate exists, though based on a much less certain foundation, and constituting a far more rickety edifice than yours might be. You cannot, I have said, complete your knowledge of disease during your study here. You may, nevertheless, among the out-patients, and in the wards, and more especially in the dead-house, of this great hospital, learn that of disease which, neglecting to learn here, you will never be able to learn elsewhere. Here alone can you acquire the art of examining disease in the living; here alone can you examine the results of disease in the dead.

The knowledge, then, both preliminary and professional, you will have to obtain during your few years of hospital study is enormous in its amount, and in its kind not only most various, but for the most part very different from any to which you have previously devoted yourselves. It is lamentable that this should be the case, and reflects seriously upon those on whom the charge of general education in this country chiefly depends. Both as regards the attainment of real knowledge, however, and the training of your powers of observation, your judgments, and your understandings, many of you will, I believe, gain more during your first year of study here than during the last half-dozen years of your previous lives. But to achieve this gain, you must work laboriously and continuously. Even the ablest of men cannot afford to dispense with work. I have set before you the career of Sir William Lawrence, not, perhaps, as an example to you in every respect, for men of his extraordinary powers could not fail of success in any walk of life, and might safely neglect the special requirements demanded by any particular walk. But even he would never have

succeeded, either in surgery or any other profession, without work. Referring to Lawrence in his student-days, Sir Benjamin Brodie wrote of him, some fifty years afterwards, "I never knew anyone who had a greater capacity of learning than he had, or more industry." I have said that the amount of knowledge you will have to acquire is enormous. Still it is not more than can be acquired, or more than habitually is acquired, by industrious men, an appellation which all of you must make it a point to deserve. Remember that the period of your sojourn here is the most important period, is indeed the seed-time, of your lives. With a view to the harvest of ultimate success in life, if for no nobler object—for the sake of your own future happiness and self-respect, still more for the welfare of those committed to your charge, take care that that time is not misspent or frittered away. What you may if you please secure now, you will never be able to attain hereafter. Let me then entreat you to make the most of your present opportunities. Let me say to each one of you—

> "Stay, stay the present instant!
> Imprint the marks of wisdom on its wings!
> O, let it not elude thy grasp, but, like
> The good old patriarch upon record,
> Hold the fleet angel fast until he bless thee!"

REPORTS OF SOCIETIES.

PHARMACEUTICAL SOCIETY.

FIRST MEETING OF THE SESSION.

Wednesday, October 2, 1867.

T. H. Hills, Esq., Vice-President, in the chair.

Several donations to the library and museum were announced, and the thanks of the meeting given to the donors. Amongst them were some well executed drawings by Mr. Brady, illustrating the appearance of quinodine, the urinary deposits, &c., under the microscope.

The Chairman then proceeded to present to the successful competitors the prizes and certificates of merit awarded at the conclusion of the last session, first calling upon the Professors to report the results of their respective examinations.

Professor Redwood reported the results of the examinations in chemistry and pharmacy, and in doing so he spoke very highly of the conduct of the class, both as regards attendance and behaviour.

Professor Bentley, in reporting the results of the examination in botany, also alluded to the exemplary conduct of the pupils, as well as to the progress they had made.

Professor Attfield reported the results of the examination in practical chemistry, which were very satisfactory. In speaking of examinations, he said they were not the best proofs of a man's qualifications, although they are the best we possess. Knowledge gained by practical experiments was more lasting than that derived solely from books.

The Chairman then gave some excellent advice to those who had received the prizes, speaking of the good they would receive by attending the meetings and rallying round the Society. He had attended the meetings regularly for a number of years, and never went home without deriving some good.

Mr. Morson made some remarks upon a remarkable case of the crystallisation of borotartrate of potash. A solution of borotartrate of potash had been placed in a bottle previous to its being converted into scales. On examination it was found to have become solid, and retained the shape of the bottle, which was broken. He had mentioned it to Dr. Redwood, who would give them the results of his experiments.

Professor Redwood said that borotartrate of potash, or soluble cream of tartar, was considered an uncrystallisable substance. It was obtained by making a solution of boracic acid, or borax, and cream of tartar, and evaporating to dryness, or, if required in the form of scales, it was evaporated to a syrupy consistence and laid upon plates. He had examined it under the microscope, and made several experiments, but had not been able to discover why it had assumed such an unusual form.

Dr. Attfield made some remarks, in which he suggested that a quantitative analysis might throw some further light on the subject.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, Oct. 9, 1867.

Deep Engraving without Varnish—Spectrum of the Flame of the Bessemer Converter—Analogy of it to Stellar Spectra—Spectrum of the colour of Water and Ice through great thicknesses—New Voltaic Piles—The Pascal-Newton Forgeries.

Method of obtaining deep engraving and reliefs without varnish, by Mr. Joseph Balsamo, Professor of Physics at the College of Lecca, Italy. Starting from the fact that by pressing the finger on different points of a vibrating plate, a great variety of reliefs and bosses are formed by the distribution of sand at the surface, M. Balsamo thinks that pressure obtained on different points of a plate immersed in a galvanic bath would modify the deposit of metal at the surface. Experiments have confirmed his theory, and the mode of operation is as follows:—In a solution of acetate of iron, to which has been added some grammes of phosphoric acid, and some fragments of phosphorus, he plunged two plates of common iron, communicating one with the negative pole, and the other with the positive pole of a Bunsen battery of three elements. Between the two plates, and perpendicularly to their surface, a blade of glass is fixed, 210 millimètres long and 35 wide, so as to press by its edges the two plates suspended at the two poles of the pile. In order to better establish the contact between these two iron plates and the edges of the glass blade, he drives in two edges of wood, one on each side, between the sides of the vessel containing the ferruginous solution and the exterior surfaces of the metallic blades. After two days of voltaic action, the metallic iron is deposited on the blade suspended at the negative pole in parallel vertical bands on the two sides of it, a hollow groove alternating with a ridge in relief. The hollows correspond to the space occupied by the edge of the glass sheet, and the reliefs on the sides of this same plate. The vacant lines, that is to say, those on which the metallic iron is not deposited, were in consequence the nodal lines, the full lines on which the iron was precipitated were the reliefs, or lines of vibration.

M. Balsamo has substituted for the straight piece of glass a curved one of an S shape, so that the points of contact of the glass can form a slight sinuosity, and the iron is deposited in sinuous planes alternating with sinuous hollows. In forming the designs with the aid of glass or clay, porcelain, &c., all the parts in contact with the edges of the design will be reproduced as many times, on the same surface, as the free space left by contours is more extended. Damask work, designs in engraving or in relief work, repeated on the same surface, can be obtained thus by a simple application of the negative type against the blade suspended at the positive pole. In place of acetate of iron we can employ other solutions of iron or metallic salts.

In a communication to the Italian Society—called the Forty—of Modena, Father Secchi made the following very interesting and curious observation on the spectrum of a terrestrial flame that struck him as very similar to the spectrum of certain yellow and red stars. This flame is that which proceeds from a converter in which Bessemer steel is being made; and this spectrum, well known by

directors of iron works, when the iron is completely decarbonised, presents a series of very fine and very numerous lines or streaks which remind one of α Orionis and α Herculis, only that it is reversed. This results, undoubtedly, from the great number of metals burning in the flame, and the spectrum presents several lines well known and determined; also, this flame seemed to be the only one comparable with that of the coloured stars, and there is nothing improbable in this fact when we consider the composition of aerolites in which iron predominates. But what is most important in our terrestrial flames, we have a fertile and abundant field of observation of spectra which are closely allied to those of certain stars. M. Secchi states that he is indebted to M. Lemonnier, director of the Terre-Neuve Works, near St. Etienne, for this observation.

M. Secchi had formerly ascertained that the spectrum of the colour of sea water is deprived of its red portion at small depths, and successively of the yellow and green, at least partially, for the greater depths, and then it appears of a violet blue. He tried to find out whether the same was the case in glaciers, and made some interesting experiments in an artificial grotto in the Grindenwald glacier. This cavern was 100 mètres deep, transparent in its walls, through which the solar light penetrated. This light was of a fine blue tint. In this shade of colour the red was extremely weak, so that in this grotto human countenances had a cadaverous aspect almost alarming. On looking towards the entry, at a certain distance in the cavern it appeared to be lit up with a red light, undoubtedly the effect of contrast. The thickness of the superposed mass was not enough to show a greater effect than the almost complete absence of the red, and a great diminution of the yellow. The ice was said to be 15 mètres thick, but it was probably less. The ice was perfectly compact, limpid as crystal, but with a few air bubbles. The hardness was not considerable.

At the Academy of Sciences, on the 23rd ult., M. Peligot presented, in the name of M. J. E. Balsamo, a memoir on the unipolarity of iron in liquids, and a new voltaic pile.

The pile is formed of two blades of iron, one plunged in dilute sulphuric acid, the other in a solution of chloride of sodium separated from the acidulated water by a porous diaphragm. The iron of the acidulated water acts as zinc, and that of the saline solution acts as copper. The current, constant and of considerable intensity, proceeds from the property possessed by iron of polarising itself differently in certain solutions between which osmogenic action takes place.

If two blades of iron of the same molecular constitution be suspended at the two poles of a galvanic bath (acetate of iron and phosphoric acid) animated by the current capable of decomposing the salt of iron of the bath, the plate suspended at the positive pole will be attacked as usual, while the blade suspended at the negative pole is covered with a homogeneous and thick coating of iron. Experiments have proved that the first iron is electro-positive, as zinc, and that the second acts electro-negatively, as copper; perhaps it is because the iron suspended at the positive pole is combined with a small quantity of phosphorus. M. Balsamo plunges, at the same time, in oxalic acid, two small magnetised bars of the same surface and of the same weight, one having its north pole in the liquid and its south pole out of it. The second bar is in the contrary position. The first acted as zinc, the latter as copper, and a current of electricity was the consequence.

The insertion in the Chemical News of the letter of Mr. Robert Grant makes us revert to the question of the authenticity of M. Pascal's letters. The long discussion of Mr. Grant only proves one thing, and that is, that the figures in the notes of Pascal are those of the third edition of the *Principia*; or, rather that Newton hae only inserted in his third edition the figures that he had received in 1658. It does not prove at all that Pascal was not in possession, or could not be in possession of observations exact enough to deduce the figures of the notes. He does not demonstrate either the astronomic authenticity of the figures which should serve as a base for the calculations of Newton.

But M. Chasles has brought to light letters from Galileo, Flamsteed, Huygens, Polignac, &c., &c. We are also informed that the observations which have served as a basis to Pascal's calculations come from Kepler and Galileo, but the figures in the third edition of the *Principia* (1760) come from the hands of Galileo, who had them, as he declares, from Pascal.

To resume: 1. Acquainted with the fact that the essential difference between the writing in the autographs and that of the authentic letters of Newton consisted principally in the conformation of the *e* and *d*, M. Chasles has shewn that many of these documents had the two characteristic forms required. 2. These autographs date evidently as far back as the 17th century, and contain four authentic signatures of Newton. Sir David Brewster affirms that after a publication brought out in this century in the General Dictionary, or the Macelesfield Correspondence of 1841, these signatures were made. 3. Messrs. Hirst and White, thinking that they had made a discovery, and proud of finding in the collection of Desmazeaux and Clarke the text of the notes of Newton, did not expect to learn from M. Chasles that Desmazeux, whose collection he has, only reproduced the documents passing through his hands, and that Newton sent, under the form of notes to Clark, arguments in favour of Leibnitz. 4. M. Grant finds in the third edition of the *Principia* in 1725, Pascal's figures purposely different from those of the second edition, but he was not aware that the same figures were attributed in 1760 to Pascal by an authentic letter of Galileo.

F. Moigno.

CORRESPONDENCE.

THE SODA TRADE.

To the Editor of the Chemical News.

Sir,—In answer to the remarks of "A Practical Chemist" in your last impression, I beg to observe that the practice stigmatised as a "barefaced fraud" is not so much the mere use of 24 as the equivalent of sodium, as the habitual invoicing of sales of soda ash as containing a considerably higher percentage of available alkali than that really present. To take an example: pure Na_2CO_3 contains (on the supposition that Na = 24, C = 12, O = 16) 59·26 per cent of Na_2O; whilst of Na = 23, it contains 58·49, the difference between the two being 0·77 per cent out of 59·26: on a 48 per cent ash, accordingly, the difference would be $\frac{48}{59\cdot26}\cdot\frac{0\cdot77}{59\cdot26}+0\cdot77$, or 0·62 per cent; that is, the real percentage would be 48 − 0.62, or 47·38 per cent. If, however, such ash were invoiced at 2 per cent above its real strength, it would be called 49·38 per cent—say 49 per cent; and if the commercial analyst referred to by either party adopted such a mode of computation as would allow this invoice to pass unchallenged (and the writer has known many such instances), the result would be that the purchaser would pay for 49 units, whilst the ash, even on the supposition that Na = 24 only contained 48 units; accordingly, it does not appear a very extravagant statement that in this case the purchaser is "defrauded."

If the taking Na = 24 were a point simply affecting trade customs, it would be of no more material consequence than the selling of some goods by the ton of 20 cwt. and others by the ton of 21 cwt.; but as none of the higher class of chemists accept this equivalent, and as there is no reason whatever to be assigned for its retention, whilst, in addition to the scientific inaccuracy, there is the objection that it opens the way to disputes, and is the cause of considerable discrepancies in the analysis of the same

substance by different analysts, it is evident that the abolition of this custom would ultimately be attended with advantage to the manufacturer, and would also tend to raise commercial analysts from the somewhat low position they unfortunately hold at present.

With respect to the iron process for bleaching powder determinations, I have only to remark that visibly effloresced crystals of ferrous sulphate are uniformly more or less peroxidised, and are totally unfit for use. With pure chemicals and careful manipulation I have always obtained precisely identical results with both the iron process and the sodium arsenite process, in the absence of chlorate in the sample analysed.—I am, &c.,

CHARLES R. A. WRIGHT, B.Sc.

Edinburgh, October 5, 1867.

To the Editor of the Chemical News.

SIR,—I have read with much pleasure the communications of Mr. Wright, giving us, as they do, a brief glance at all the methods capable of being employed in commercial determinations. As he does not mention it, I think the process I employ for the determination of manganese must not be generally known. I place a given weight of the manganese with HCl in a small flask with a leading tube attached. I absorb the Cl by means of a solution of $NaOCO_2$, using an inverted retort for a condenser; then by means of a solution of arseniate of soda I estimate the Cl, and thus arrive at the percentage of MnO_2; or rather I have prepared a set of tables for this and other determinations, by referring to which I can without calculation, or at least with the simplest possible, arrive at what I want. Of course I claim no credit for this adoption. The thing appears so obvious to substitute two commonly occurring materials for the KI and SO_2 of Bunsen's process, that I should have supposed it in use in every laboratory where such determinations were made.—I am, &c., P. H.

MISCELLANEOUS.

Forthcoming Scientific Books.—Amongst Messrs. Churchill's literary announcements for the ensuing session we find the following:—

"The Microscope and its Revelations." With 400 plates and wood engravings. By W. B. CARPENTER, M.D., F.R.S. Fourth edition.

"Companion to the British Pharmacopœia of 1867," comparing it with the Pharmacopœias hitherto used in Britain; including that of 1864; also the new editions of the U.S., the French, and the Prussian Pharmacopœias. By PETER SQUIRE, F.L.S. Fifth edition.

By the same author, "The Pharmacopœias of the Principal Hospitals of London." Arranged in groups for easy reference and comparison. Second edition.

"Germinal Matter and the Contact Theory. The key to the prevention and study of zymotic disease." By JAMES MORRIS, M.D., Lond. Second edition.

"Urine, Urinary Deposits, and Calculi, and on the Treatment of Urinary Diseases." With numerous plates. By Dr. LIONEL S. BEALE, F.R.S. Third edition, very much enlarged.

"Chemical Notes to the British Pharmacopœia of 1867." By CHARLES HENRY WOOD.

"The Induction Coil: being a Popular Explanation of the Electrical Principles on which it is constructed." With a series of beautiful and instructive experiments. By HENRY M. NOAD, Ph.D., F.R.S., F.C.S. Third edition, with engravings.

"On the Action and Use of Oxygen. With selected cases proving its value in the treatment of various intractable diseases." By S. B. BIRCH, M.D., M.R.C.P., Lond. Second edition.

"The Calendar of the Pharmaceutical Society of Great Britain."

"First Lines for Chemists and Druggists preparing for Examination." By JOHN STEGGALL, M.D. Third edition.

"On Local Anæsthesia and Volatile Fluid Spray in Medicine and Surgery." By BENJAMIN W. RICHARDSON, M.D., F.R.S.

"The First Step in Chemistry: a new method of teaching the elements of the science." By ROBERT GALLOWAY. Fourth edition.

The Borax Company, engaged in taking out borax, in Lake county, will soon be in condition to extract five tons of this article per day from the borax lake, as they have just received a new and powerful steam dredger and an immense pump, with which to exhaust the water from the coffer dams. This pump weighs something over 1,000 pounds, and is to be worked by steam.—*Mining and Scientific Press.*

Poisoning by Caustic Potash.—A death has recently occurred at Pendleton, caused by drinking the contents of a jug supposed to contain porter, but which in reality contained a solution of caustic potash. The deceased drank it on the 22nd May, and lived until the 20th September. Mr. Heywood, surgeon, Pendleton, who had attended the deceased, stated that he had been unable to swallow anything during his illness, and he attributed death to starvation in consequence of that inability. He had made a *post-mortem* examination of the body, and found a stricture of the œsophagus, extending over four or five inches, rendering swallowing an impossibility. The injury had been caused by taking caustic potash.

The Atmosphere of the Metropolitan Railway.—The inquiry respecting the death of E. Stainsby, who died on the 28th of August, at the King's-cross station of the Metropolitan Railway, after travelling from Bishop's-road station, was resumed on Friday last by Dr. Lankester. The inquest had been twice adjourned for the purpose of having scientific evidence as to an analysis of the atmosphere in the tunnels of the railway laid before the jury, so as to lead them to a just conclusion as to whether the death of Elizabeth Stainsby was accelerated by the condition of the atmosphere in the railway between Bishop's-road and King's-cross stations. The Coroner said he had received a communication from Mr. Fenton, the general manager of the Metropolitan Railway Company, in which he stated that the scientific evidence which the company wished to lay before the jury was not yet completed. The scientific referee whom he (the coroner) had appointed, had he believed, completed his experiments, but still he thought it well that the jury should have the whole evidence before them in order that they might arrive at a right conclusion. He had received assurances from a great many persons that the ventilation of the Metropolitan Railway had been much improved. Therefore, setting aside any result at which the jury might arrive as to the death of Elizabeth Stainsby, it appeared that from the fact of the deceased and others having complained of the atmosphere of the railway, the directors had done something to remedy the evil. Therefore, the jury would not feel that their time was lost in keeping a watch over this railway for the benefit of the public. It had been said that the jury and he were unnecessarily intefering with the railway company, but he might remark that he had received many communications from persons who stated that they had felt very much oppressed in their breathing while in the tunnels of the railway, and from others who had been advised by their medical attendants to give up travelling upon it. He had also received many letters suggesting modes of improving the ventilation in the tunnels, so that the jury would see the inquiry was very important, and absolutely necessary for the public interests. Everything that could be put before the jury in the shape of information ought to be adduced, both for the sake of the public and of the company. He proposed that the inquiry should be adjourned to Wednesday, the 30th of October. The jury acquiesced in the suggestion, and the inquiry accordingly stood ajdourned.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Bulletin de l'Academie Royale de Belgique (Classe des Sciences).

June.

A. QUETELET, "Note on the Publication of the Meteorological Annals of the Royal Observatory at Brussels." A. QUETELET, "Extract from Chacornac's Letter on Sun Spots, and on the Disappearance of the Crater of Linnæus."

Monatsbericht der königlich-Preussischen Akademie.

April.

RIESS, "On Double Induction, and on the Theory of the Electrophorus." G. ROSE, "On the Meteorite which fell at Knyahinya, in Hungary, on June 9, 1866." J. PHILIPP, "On the Sulphocyanogen Compounds of Mercury." C. RAMMELSBERG, "On Phosphorous Acid and its Salts." E. REUSCH, "On the Effect of Pressure on Rock Salt and Calcite." H. HELMHOLTZ, "On N. Baxt's Experiments on the Velocity of Propagation of Irritation in the Motor Nerves of the Human Body."

Poggendorff's Annalen.

April 12.

H. BUFF, "On the Inductive Action of a Voltaic Current on the Mass of the Conductor." C. BOHN, "On Negative Fluorescence and Phosphorescence." E. VOIT, "On the Diffusion of Liquids." W. VON. BEZOLD, "On Binocular Vision." A. SCHRAUF, "On the Deduction of the Form of Crystals from the Refractive Equivalents of the Elements of which the Crystal is composed." E. REUSCH, "An Experiment with Prince Rupert's Drops."

May 16.

A. TOPLER, "On the Construction and Performance of the Rotating Electrophorus." A. MITSCHERLICH, "On some new Methods of Determining the Constitution of Organic Compounds." W. BEETZ, "On the Influence of the Motion of the Origin of a Sound on its Pitch." G. JENZSCH, "On the Laws of the Formation of Twin Crystals of Quartz." A. BRIO, "On the Optical Properties of Hyposulphate of Baryta."

Annalen der Chemie und Pharmacie.

Supplement. Vol. 5. No. 1.

C. ZWENGER, "On the Melilotic Acid, and on its Preparation from Coumarin." L. DARMSTAEDTER, "On Potassio-Chloride and Ammonio-Chloride of Gold."

July 1867.

H. WICHELHAUS, "On the Constitution and Composition of Organic Acids containing three Atoms of Carbon." H. SCHRODER, "On Hypogæic Acid." O. HAUSSKNECHT, "On some Derivatives of Erucic Acid." C. WEINHOLD, "On Oxyphenylene Sulphurous Acid." H. KOLBE, "Remarks on the foregoing Paper." H. KOLBE, "On the Sulphuric and Sulphurous Ethers." R. WARLITZ, "On the Sulphurous Ether Isomeric with Ethylsulphuric Acid." R. OTTO AND L. BRUMMER, "On Sulphochlorobenzolic Acid, and on some Derivatives of the same."

Annnales de Chimie et der Physique.

July.

A. CORNU, "Researches on Crystalline Reflection."

Journal des Fabricants de Papier.

June 15.

E. BOURDILLIAT, "On Testing the Chemical Products used in Paper-making: Starch."

July 1.

E. BOURDILLIAT, "On Testing the Chemical Products used in Paper-making. Continuation: Ultramarine. Antichlore. Prussiates of Potash."

Journal für Praktische Chemie.

June 8.

A. KENNGOTT, "On the Alkaline Re-action of some Minerals." A. KENNGOTT, "On Richmondite, Osmelite, and Neolite." A. KENNGOTT, "On Pyrophyllite, Hydrargillite, Pennine, Chlorite, and Clinochlore." L. R. VON FELLENBERG, "Analysis of a Green Mineral (Anorthite? Felspar?) from the Bernese Oberland." L. R. VON FELLENBERG, "Analysis of Serpentine from the Malenkerthal in the Grisons." L. R. FELLENBERG, "Analysis of Calcite from Merlingen." T. BAIL, "On the Formation of Yeast." E. CARSTANJEN, "On Thallic Acid."

June 20.

B. WEISS, "On the Colouring Matter of Saffron." R. WAGNER, "On the Detection of Woollen Fibres in Silk Goods."

June 27.

R. HOFFMANN, "On the Causes of the Brittleness of the Bones of Horned Cattle." J. C. LEUCHS, "On the Bitter Principal of Hops, and on Deoxidation as a Means of Destroying the same. F. STOLBA, "An Analysis of some Ancient Bronze Objects, from the Collection in the Bohemian Muscum at Prague." F. STOLBA, "On the Analysis of Bone Black." F. STOLBA, "On the Quantitative Estimation of Lead by Precipitation by Zinc." F. STOLBA, "On the Estimation of the Water of Crystallized Fluoride of Calcium Compounds. J. WOLF "On the Constitution of some Aniline Colours."

NOTES AND QUERIES.

To Preserve Fresh Flowers.—Put a pinch of nitrate of soda into the water every day when you change it. This will preserve flowers for a fortnight. Nitrate of Potash in powder has nearly the same effect.—ISABEL DE W.

Detection of Sulphur in Petroleum.—"Refiner" will find the following plan, suggested I believe by Dr. Vohl, answer his purpose:—Digest the oil for some hours at a gentle heat with a small piece of sodium. Water being added, the aqueous solution is to be tested with nitro-prusside of sodium. The presence of sulphur is shown by the production of the well known purple colouration.—E. S.P.

Scarlet Ink.—Take garancin of best quality one ounce, digest with liquor ammoniæ one ounce, add one pint of cold distilled water triturate together in a mortar, filter, and dissolve in the solution half an ounce of gum arabic; or take pure carmine twenty grains, liquor ammoniæ three fluid ounces, dissolve, then add eighteen grains of powdered gum.—DR. A.

Succinic Acid.—The property of acetic acid to prevent the ordinary reaction of succinic acid alluded to by your correspondent, J. Hooper, in your last week's Notes and Queries column, is not new, although it does not seem to be generally known. More than forty years ago, two French chemists, named Lecann and Serbat, pointed out that the presence of acetic acid takes from succinic acid the power of forming precipitates with solutions of iron, copper, lead, and barium. Neither will a mixture of acetate and succinate of potash precipitate solutions of these metals.—ABEL SCOTT.

Development of Heat.—I was reading in a scientific work the other day, that air may be driven with so much force as to set solid substances on fire; and that ice may be dashed with such violence against another piece of ice that sparks of fire will be produced by the collision. Can any one tell me where the record of these experiments may be found, and who was the experimenter? I am aware that Sir H. Davy produced heat by rubbing two pieces of ice together, but I have never heard of fire being produced by the ice; perhaps some of your readers may enlighten me.—CRUCIS.

Sulphur in Petroleum.—It is not quite clear whether your correspondent wants a test for sulphur or any of its acids, since in refining petroleum sulphuric acid is used; however it seems at all events best to convert any sulphur compounds into sulphuric acid, and test for the latter. The oil may be decomposed by careful treatment with nitric acid, and afterwards the residue, after complete decomposition of the oil, diluted with water, and treated with nitrate of baryta to detect sulphuric acid. It must not be lost sight of that when sulphuric acid is used for refining, this will have to be removed entirely first, while one must also bear in mind that its use entails the possibility of engendering sulpho-oils not attacked by alkalies.—A.

TO CORRESPONDENTS.

W. E. Gill.—Received with thanks.

Wm. Johnson Sollas.—A letter addressed to Messrs. Bailey and Sons, Wolverhampton, will obtain for you the desired information.

Henri Du Chemin-Creux.—Your letter has been forwarded.

H. Dixon.—The subject is more suitable for our advertisement columns, than for our Notes and Queries.

H. Bowler, Philadelphia.—The journal shall be forwarded if possible.

J. D. M.—No fuller particulars have been published for obtaining oxygen from bleaching powder than appeared in the number of the CHEMICAL NEWS containing the announcement.

Ellora.—The new cement you refer to is not oxy-chloride of manganese, but oxy-chloride of magnesium. It was described by M. Sorel, before the French Academy a few months ago.

A. R. A.—Nearly all specimens of fluor spar are very phosphorescent. The native carbonates of lime are so in a less degree. M Heinrich has published some very interesting experiments on this subject. He exposed the substances for about 10 seconds to the light of a clear day, but out of the direct rays of the sun to prevent their becoming heated; the observer was for 30 or 40 minutes previously in a perfectly dark chamber. The diamond and fluor spar shine for above an hour, but nothing else for more than a minute. When shining if a deep cut be made in the substance it will be seen to be as luminous at the bottom as at the surface.

Communications have been received from W. H. Smith (with enclosure); L. Power; W. E. Gill (with enclosure); J. Maculloc (with enclosure); H. Dixon; Henry Bower; Prof. H. How (with enclosure); *W.* Inglefield; W. Godwin (with enclosure); J. Watson; J. D. Muter; P. Sharp (with enclosure); S. W. Hinde; C. G Williams F.R.S.; F. Cochrane; Dr. Odling F.R.S. (with enclosure); W. H. Harrison; A Smart (with enclosure); J. Salter; T. Maguire (with enclosure) W. Tillson; H. Day (with enclosure); O. Schmidt; W. J. Suffolk; H. Monfitt; W. Johnson Sollas; Dr. Adriani; John Heywood; Alex. Parkes; J. Herschel; John Bray F.C.S.; E. P. Sandbury (with enclosure); E. Corbett (with enclosure); G. F. De Winton; E. Schenck (with enclosure); John Spencer; Maclachlan and Stewart; B. W. Gibsonc; T. A. Readwin. P. Hart (with enclosure); S. Mellor.

Books Received.—"A Lecture on the Sewage difficulty, by Baldwin Latham. C.E.

THE CHEMICAL NEWS.

Vol. XVI., No. 411.

ON A

NEW APPARATUS FOR TECHNICAL ANALYSIS OF PETROLEUM AND KINDRED SUBSTANCES.

By S. F. PECKHAM.

In the Chemical News for August 31st, 1866, I noticed a paper in which was described a process with apparatus, for the essay of coals and other substances yielding illuminating and paraffin oils.* After stating the fact, that no process had hitherto been described by which technical analyses of bituminous and pyro-bituminous substances could be made to yield analogous and satisfactory results, the author proceeds to describe what I should suppose to be a very valuable process for the primary distillation in the technical analysis of coals and shales. I do not repeat the description here, as it would require considerable space, and it can only be applied to the treatment of solid substances, which do not melt at a temperature below that required for their distillation. As the original paper is easy of access, I would recommend its perusal to all who wish to make technical analyses of either coals or shales. The apparatus is simple and inexpensive, and I am aware of no reason why the results furnished by it should not prove highly satisfactory, especially as its operation bears a striking resemblance to the most improved processes of manufacture on the large scale.

But beyond the primary distillation of the coal or shale, I do not consider that our author has added anything to processes long in use. When he arrives at the second distillation, or that which corresponds to the primary distillation of petroleum, he is forced to return to the old process of fractional distillation from a common tubulated glass retort. This process is not only very unsatisfactory in its results, but it is quite expensive, and is attended with considerable danger from fire. It is unsatisfactory, because the separation of fluids of different densities and different boiling points, is much less complete than by Warren's process, for any temperature below the boiling point of mercury; in fact, for any temperature necessary to ensure the complete separation of the light oils usually called naphtha, and the "photogen" or illuminating oil.† It is expensive, for the reason that if the distillation is conducted to dryness the retort is sacrificed, as it is rarely possible to remove the coke with safety. It is attended with danger from fire, because the best retorts are liable to fracture from the high heat to which they are exposed, even when the greatest care is exercised in conducting the operation.

I was about to commence a technical examination of several specimens of California petroleum, when the above mentioned paper arrested my attention, and I was unpleasantly conscious when I had finished its perusal that in respect to apparatus for this department of research my want was just as far from being supplied as it was six years since, when I commenced the study of petroleums. I had but a small quantity of each specimen, and besides subjecting them simply to fractional distillation, I wished to test them by Young's process of distillation, under pressure. To conduct the latter process in glass was an impossibility.

To answer my purpose therefore, my apparatus must fulfil the following conditions. It should be capable of working not more than one and one-half litres, and admit of being heated by an ordinary gas furnace. The joints should sustain a pressure of forty pounds per square inch, and it should be so constructed as to admit of the ready extraction of the coke. I could find no description of any such apparatus, but after numerous failures and corrections, in an apparatus of my own invention I found my want so well and fully supplied, that I am led to offer a description, for the benefit of those who, like myself, have felt the need of such an instrument.

Upon each extremity of a piece of a wrought iron gas-pipe, three inches in diameter and twenty inches in length, a cap is securely screwed. The caps should be heated nearly to redness and screwed on to the cold pipe in order that by their contraction they may be more firmly secured. The pipe is then put in a lathe and the caps turned off in such a manner as to leave a band upon each end of the pipe, about three-fourths of an inch in width, and two circular discs of iron, each about four inches in diameter, and one-fourth of an inch in thickness, having a projection upon one of their surfaces to which a wrench may be applied. The edges of each extremity of the pipe with the bands are now carefully turned off, presenting smooth surfaces slightly bevelled inwardly. The plane surface of each of the discs is then so turned off upon its circumference, that it will exactly fit the bevelled edge of the pipe. This completes the retort.

A stout parallelogram is then made half an inch longer and wider than the retort, one of the shorter sides of which should contain in the middle a stout set-screw, and the other an orifice made to fit the projection upon the disc. This may be called the frame.

Two holes are then drilled a short distance from either extremity of the retort, and in a line parallel to the axis of the retort. One of these should admit a half inch, and the other an inch gas-pipe. With this arrangement the retort may be used either for pressure distillation, or for distillation by the ordinary process. It also admits of being connected with an apparatus for furnishing superheated steam or carbonic acid gas, either of which are sometimes used to assist the distillation of hydrocarbons. Both the goose-neck and valve should be connected with the retort by a short piece of gas-pipe and a brass "union" or coupling, as the difference in the expansion of brass and iron would cause a joint of the two metals to leak very badly when subjected to a high temperature. The goose-neck may be made of the ordinary form, tapering from one inch to one-quarter inch, and about ten inches in length. The material should be copper, brazed. The valve will be described hereafter.

In order to use the retort, one of the discs is luted with a very thin paste of plaster of Paris, and firmly pressed into its seat. The retort is then slipped into the frame and left a moment for the luting to set, the open end being uppermost. The oil is next poured in and the other disc luted into its seat, the frame adjusted and the set-screw firmly set up, so as to securely fasten both discs in their places. The goose-neck or valve is then adjusted, and the connections made with the worm and receiver. It will be observed that all the expansion that takes place in this retort only brings the different portions of the apparatus more firmly together, instead of causing them to crack apart and leak with every slight variation of temperature, as is usually the case. With this arrangement I was able to distil fifteen hundred cubic centimeters of petroleum to dryness, the last portions coming over at a red heat. The distillation was commenced with two ordinary Bunsen's gas lamps, increased as required to four, and towards the end of the operation to six—the latter number being sufficient to bring the side of the retort in contact with the flame to a bright cherry-red heat.

* On the Assay of Coal, &c., for Crude Paraffin Oil, and of Crude Oil and Petroleum for Spirit, Photogens Lubricating Oil and Paraffin, by John Attfield, Ph.D., F.C.S., Director of the Laboratory of the Pharmaceutical Society of Great Britain. Chem. News, vol. xiv. p. 98.

† For details of this process, see Chem. News, vol. xii., p. 85.

Any one who has attempted the distillation of small quantities of petroleum in either iron or copper stills, or retorts of whatever form, imbedded in coal fires or suspended over them, must be aware of the difficulty of so regulating the fire as to secure a constantly increasing heat from beginning to the end of the operation. No such difficulty is experienced with this apparatus. In it the lightest oils may be distilled by means of a sand-bath, and the heaviest by applying the flame of a sufficient number of lamps directly to the retort. The joints of this apparatus when luted with the smallest possible quantity of finely pulverized calcined sulphate of lime, admit of the least loss by leakage of any metallic retort that I have ever used. With the exercise of proper care the amount of distillate from California petroleum averaged above ninety per cent by measure, and with a pressure of thirty pounds per square inch the average was eighty-seven and one-half per cent. In the latter instance the loss was increased by the formation of gas and vapours that passed through the worm uncondensed at 8° C. The largest amount of distillate that I have seen recorded, as yielded by any material of undoubted natural origin, is ninety-five and one-half per cent, by measure.* The distillation of which this was the product was performed wholly in glass, without pressure, the crude material being a California petroleum of medium density, yielding no permanent gases and no naphtha. In this case the loss may be estimated at zero. I think it will be readily conceded, that any apparatus which admits of the ready extraction of the coke, and at the same time yields an average of ninety-two and one-half per cent of distillate, furnishes results far more satisfactory than any hitherto in use for operating upon so small a quantity as fifteen hundred cubic centimeters.

A thermometer may be inserted in the smaller orifice, for noting the temperature at which light oils distil. A piece of gas-pipe of the requisite size and about two inches in length may be used for making the connection, the thermometer being luted into one end of it. When but one of the openings in the retort is in use, the other may be closed with an iron plug.

In making my experiments upon Young's process of distillation under pressure, I experienced much difficulty in contriving an apparatus that would enable me to register the amount of pressure, and at the same time prevent any loss of vapour. I first attempted to register the pressure by means of a U tube, the arms of which were of unequal length. The tube was filled with mercury to a level with the shorter arm, and the long arm sealed with a column of air above the mercury. The pressure was indicated by the rise of mercury in the longer arm and consequent compression of the air, the shorter arm being in communication with the retort. The escape was badly regulated by an ordinary stop-cock. The very unequal expansion of glass and iron prevented me from making a tight joint between the retort and U tube.

I next tried a small valve constructed like an ordinary safety-valve. I found it impossible with this valve to prevent a large amount of loss from escape of vapour around the spindle.

I next tried a loaded valve, the load of which was placed directly upon the spindle, the whole contained in a chamber resembling a miniature steam-chest, from which the vapours could only escape into the worm. It was found upon trial with the safety-valve that an orifice three-eighths of an inch in diameter was too large in proportion to the size of the retort, the vapours escaping in too large volume to admit of a continued flow from the worm. The vapour escaped in intermittent puffs, thereby causing an undulatory movement from the requisite amount of pressure to no pressure at all. As a consequence, the results rendered were very imperfect. To obviate this difficulty, I made the orifice beneath the valve only one-sixteenth of an inch in diameter, the surface of the orifice being to that of the retort as one to sixty thousand. This arrangement enabled me to secure a constant flow of vapour from the retort, to maintain a constant pressure, and to preserve a constant degree of temperature. I found by computation that a pressure of two ounces avoirdupois upon an orifice one-sixteenth of an inch in diameter was equivalent to a pressure of forty pounds to the square inch, yet when I placed a weight of two ounces upon the spindle, which of itself weighed half an ounce, the steam gauge registered only ten pounds, and the oils passed through it unchanged in density. Although I employed one of the most skilful workers of brass in this city to grind the valve, I am satisfied that the fault was in the mechanical execution of the work, and that the bearing of the valve was upon the side of the cone instead of at its apex, leaving a minute cavity beneath the valve. This fault could only be remedied by increased pressure. The chamber being too small to admit of placing the requisite weight upon the spindle, I made use of a spiral spring, the force of which was adjusted by an ordinary steam-gauge. By this means I was enabled to obtain the required pressure and to estimate its amount, with but one source of error, viz., the diminution in the elasticity of the spring incident to the high temperature of the vapours of the oil. I am convinced that the amount of this diminution is considerable; I have estimated it at one-fourth. The original elasticity returns, however, as soon as the spring is cold.

The following is a description of the valve as finally arranged. A piece of wrought iron gas-pipe one inch in diameter and three inches in length is bored out true, and an orifice drilled in its side one and one-fourth inches from the upper end, into which is brazed a piece of quarter inch gas-pipe about three inches in length. Both ends are now turned off and threads cut upon them, to which are carefully fitted strong brass caps. The upper cap should he about three-quarters of an inch in thickness, perforated two-thirds through from the inside with an eighth-inch drill, the orifice to serve as a guide to the upper end of the spindle. There should be a nipple three-fourths of an inch in length upon the lower cap, to connect it with the retort. The cap should be about one-half an inch in thickness, and with the nipple, should be perforated with a sixteenth inch drill. The seat of the valve should be excavated in the inside of the lower cap. A diaphragm should be placed within the iron tube, one inch from its lower end to serve as a guide for the spindle, through the centre of which the spindle should pass, while around it should be numerous small openings to allow for the free passage of the vapour. The valve itself should be turned upon the end of a spindle three-sixteenths of an inch in diameter, and carefully ground into its seat. The length of the spindle should be one-fourth of an inch less than the distance from the seat of the valve to the bottom of the orifice upon the inside of the upper cap, when both caps are in position. This allows the spindle to lift well, with sufficient room for the passage of the vapours. The diameter of the spindle should be reduced to one-eighth inch above the diaphragm. A spiral spring, of a diameter nearly equal to the interior of the pipe, made of brass wire about one-sixteenth of an inch in thickness, is so adjusted that the valve would be raised against the elastic force of the spring. This is effected by gradually reducing the diameter of the coils of the lower end of the spring to one-eighth inch, when it will just rest upon the shoulder upon the spindle. The upper coil of the spring should just touch the inside of the upper cap, when it is firmly screwed up. It will thus be seen that a force sufficient to cause the spring to contract one quarter of an inch is equal to a direct pressure upon the valve of two ounces. This depending for the same length of spring and size of wire upon the *number* of coils employed.

* Report of C. M. Warren, Esq., contained in an article on Petroleum in California, by Prof. B Silliman, National Intelligencer, Feb. 1h7, 1866.

With this apparatus and the one described by Mr. Attfield, small quantities of every variety of bituminous and pyro-bituminous substances, may be subjected to treatment analogous to the most improved processes now in use upon the large scale. The results are reliable and admit of ready comparison. The cost of the retort with goose-neck add valve, made by the most skilful work-men, is about twenty-five dollars.

ON THE

PRODUCTION OF SOME NEW METALLIC SULPHOCYANDES,

AND THE SEPARATION OF CERTAIN BASES FROM EACH OTHER BY THE METHOD THEREIN EMPLOYED.

By WILLIAM SKEY,
Analyst to the Geological Survey, New Zealand.

The principle employed in the production of the following sulphocyanides is their great solubility in ether, by which not only can they be readily removed from their aqueous solution, but even their production in some instances determined.

Sulphocyanide of Cobalt.—If an alkaline sulphocyanide is added to an aqueous solution of a salt of cobalt, the colour thereof is merely browned, or, if ether is shook up with the cobalt salt, it remains colourless; but if ether is shook up with a mixture of the two salts, a blue colouration instantly results, which, on the subsidence of the water, is found to be confined to the ether. The etherial solution left to evaporate spontaneously, affords beautiful slender crystals of a dark blue colour, containing sulphocyanogen and cobalt.

If alcohol is substituted for ether, the solution of the mixed salt is also coloured blue. The blue colour is destroyed by acetate of soda, chloride of mercury, and hyposulphite of soda.

Suphocyanide of Uranium.—If ether is agitated with a solution of chloride of uranium, it remains colourless, but the addition of sulphocyanide of potassium thereto determines the uranium to the ether on further agitation, after first markedly increasing the colour of the uranium solution. On examination, the whole of the metal is found in the ether united with the sulphocyanogen. If iron is present, the etherial solution will have a more or less red colour. In this case a deoxidizing agent is necessary to remove the iron, and thus manifest the colour proper to uranium.

Sulphocyanide of Molybdenum.—A solution of molybdic acid in hydrochloric acid is coloured a deep yellow by sulphocyanide of potassium, which colour is permanent in the air at common temperatures, while the addition of alcohol does not affect it; but instantly on contact with ether the colour rapidly darkens, and continues darkening till a deep red colour is attained. Also, if zinc is placed in a molybdic solution, to which a sulphocyanide has been added, together with excess of acid, the solution acquires a deep clear red colour, and ether removes a rich magenta coloured sulphocyanide of molybdenum, having a depth approaching to that of the iron compound with the same acid. Acetate of soda instantly discharges the colour.

Sulphocyanide of Tungsten.—This salt is best prepared by first treating a solution of tungstate of ammonia with the sulphocyanide. The granular precipitate thus produced is placed in contact with hydrochloric acid and ether. In a short time the ether acquires a yellow colour, and affords to the proper test good indication of both sulphocyanic acid and tungsten.

Sulphocyanide of Gold.—This sulphocyanide is very soluble in ether or alcohol, but scarcely dissolved by water. After taking great precaution to ensure the absence of iron, the colour of the etherial solution was red.

Sulphocyanide of Copper is also soluble in ether if an excess of hydrosulphocyanic acid is present, communicating to it a dark brown colour. It can be completely removed from water by this solvent.

The metals of the following oxides or chlorides I have not been able to combine with sulphocyanogen to form compounds soluble in ether:—Oxides of manganese, sesquioxide of aluminium, sesquioxide of chromium, bichloride of platinum.

In respect to the iron compound with sulphocyanogen, its solubility in ether has been already pointed out in a former paper; but since then it has been ascertained that its affinity for ether is so great that it can be entirely removed from water by this solvent, and its presence revealed where the eye fails to detect it. And, further, that ether determines in a remarkable manner the instant and abundant formation of this coloured compound from protochloride of iron and sulphocyanide of potassium even in presence of a soluble hyposulphite—a circumstance in no ways wholly accounted for by the presence of ozone in the ether employed, since but the faintest indication of this body could be obtained.

Separation of certain Bases from each other by the method here employed.—It is I think highly probable that the principle of the abstraction of certain of the metals from water by ether in presence of hydrosulphocyanic acid might be advantageously adopted for the separation of the following metals.

1. Iron from the alkaline earths—alumina, sesquioxide of chromium, oxides of manganese, also from uranium, platinumn, and nickel.
2. Cobalt from nickel.
3. Gold from platinum.

It should be mentioned that for the separation of iron it is necessary to have the solution somewhat dilute, and for reasons which will presently appear, the solution must not be very acid.

The separation of cobalt from nickel has just been satisfactorly accomplished upon this principle.

ON THE

CONSTITUTION AND PROPERTIES

OF THE

HÆMATITE IRONS OF WEST CUMBERLAND

By EDMUND G. TOSH, Ph.D.

The composition of five specimens of Cumberland Hæmatite pig iron, as determined by chemical analysis, is given below.

	I.	II.	III.	IV.	V.
Iron ..	93·552	93·100	92·850	92·798	92·802
Graphite ..	3·082	2·952	2·997	1·902	1·879
Combined carbon	1·265	1·235	1·134	2·186	1·892
Silicium ..	1·389	2·286	2·706	2·714	2·753
Sulphur ..	0·068	0·075	0·068	0·065	0·164
Phosphorus	0·027	0·055	0·028	0·030	0·055
Manganese	0·216	0·288	0·140	0·140	0·288
Titanium	0·006	0·006	0·007	0·007	0·005
Nitrogen ..	0·056	0·041	0·051	0·051	0·049
Arsenic ..	trace	trace	trace	trace	trace
	99·661	100·038	99·981	99·893	99·887

I. II. and III. are from Cleator, Harrington, and Workington respectively, and were all manufactured specially for conversion into the best varieties of Bessemer steel. In appearance they were much alike: the fracture presented a bold crystalline structure, due to the graphite disseminated through the mass in large scales. IV. is a pig iron likewise intended for the production of steel, but on account of its containing too little free carbon or graphite, could not be successfully employed. Like the first three

specimens, its fracture was highly graphitic, but in an inferior degree. V. is the analysis of ordinary grey forge iron made at Harrington.

Before examining the parts played by the various elements of pig iron in its conversion into steel, it is necessary to give a short outline of the Bessemer process.

Highly graphitic pig iron is melted and run into a large egg shaped vessel of iron lined with some fire-resisting material, known technically as "the converter." In this vessel air is blown through the metal from beneath, the carbon and silicium are oxidised, and by their combustion produce a heat so intense, that in from 14 to 30 minutes, at the end of the process, the resulting almost pure *iron* at a dazzling white heat, may be poured out of the converting vessel in a stream almost as liquid as water. If *steel* be required, the necessary quantity of spiegeleisen (containing a known proportion of carbon) in a molten state, is added to the decarburized iron in the converter, previous to running the metal out into ingots.

If now, white, instead of grey iron be introduced into "the converter," and air blown through it, the heat does not increase, no carbon or silicium is burned. I have this upon authority of several influential steel-makers who have made practical experiments on the subject. This different bearing of white and grey iron is somewhat remarkable, as, up till the present time it has been the opinion of metallurgists, if there was a definite one on the point, that the internal arrangement of the various kinds of cast iron was very similar when in the molten state. The phenomena here presented would seem to point directly to the conclusion that the two varieties of iron, grey and white, retain in the molten state, at least to a certain extent, the constitution they possessed when solid. Karsten states that graphite in fused graphitic iron, may exist either in chemical combination or in mechanical solution. The different deportment of grey, as distinguished from white iron, inclines us to the latter opinion or an approximation to it, for besides simple solution of graphite in the mass of metal, we may admit the existence of a high carbide of iron, necessarily a much more unstable compound than that existing in white iron, and the carbon of which, being in a somewhat weak state of combination, may combine more readily with the oxygen of the air at a high temperature. Further, either the graphite or this high carbide of iron may be dissolved in a second lower carbide, nearly resembling white iron in composition. Of course any premises as to the state in which carbon occurs in iron must be in a great measure hypothetical, on account of the extremely limited and imperfect nature of our knowledge of the carbides of iron. One conclusion we may draw with perfect safety I think, that the carbon at a temperature not far above the melting point, is very differently distributed in grey and white iron respectively; and if in the latter, the 4 or 5 per cent of carbon is combined with about 95 per cent of the metal, we are justified I think in inferring that a portion of the carbon in grey iron exists in one of the conditions I have mentioned as probable.

I here give an extract verbatim from a paper read by Bessemer before the Mechanical Engineers, in which the various changes that take place during the conversion of pig iron into steel are very clearly and fully described. "The silicium always present in greater or less quantities in pig iron is first attacked, and unites readily with the oxygen of the air, producing silicic acid; at the same time a small portion of the iron undergoes oxidation, and hence a fluid silicate of iron is produced, a little carbon being simultaneously burnt off. The heat is thus gradually increased until nearly the whole of the silicium is oxidised, which generally takes place in about 12 minutes from the commencement of the process. The carbon of the pig iron now begins to unite more freely with the oxygen of the air, producing at first a small flame which rapidly increases, and in about three minutes from its appearance, a most intense combustion is going on; the metal rises higher and higher in the vessel, sometimes occupying more than double its former space, and in this frothy fluid state it presents an enormous surface to the action of the air, which unites rapidly with the carbon contained in the crude iron, and produces a most intense combustion, the whole mass being in fact a perfect mixture of metal and fire. The carbon is now burnt off so rapidly as to produce a series of harmless explosions, throwing out the fluid slag in great quantities, while the combustion of the gases is so perfect that a voluminous white flame rushes from the mouth of the vessel, illuminating the whole of the building, and indicating to the practised eye the precise condition of the metal inside. The blowing may thus be left off whenever the number of minutes from the commencement, and the appearance of the flame, indicate the required quality of the metal. This is the mode preferred in working the process in Sweden, but at the works in Sheffield it is preferred to continue blowing the metal beyond this stage, until the flame suddenly drops, which it does on the approach of the metal to the condition of malleable iron; a small measured quantity of charcoal pig iron, containing a known proportion of carbon is then added, and thus steel is produced of any degree of carburisation, the process having occupied about 23 minutes from the commencement. The converting vessel is tipped forward, and the blast shut off for adding this small charge of pig iron, after which the blast is turned on again for a few seconds."

"In the new process the carbon and silicium of the iron itself were employed as fuel to support the heat for reducing the cast-iron, and the intense heat thus obtained, together with the intimate mixing of the air blown through the metal in a fluid state, caused the reduction to be much more rapid. Instead of the silicium in the iron requiring 2 or 3 hours to be burnt out as in the ordinary puddling process, it was now burnt out in only 12 minutes, giving out a great amount of heat by its combustion: and the complete reduction of the metal occupied less than half an hour, and was accomplished with far greater certainty and completeness, while 3 to 4 tons were acted upon at once instead of as many hundredweights."

From this it would appear that silicium is first oxidised in the process of conversion, and that its combustion produces a great elevation of temperature. If this be correct, returning to the way white iron behaves in the converting vessel, it seems that not only the carbon, but the silicium too, is differently situated in white and grey pig iron in a state of fusion. An explanation of these various conditions and phenomena must at present be a matter of pure conjecture, as we are almost without information on this very important point. When the combustion of the graphitic carbon commences, the heat rises rapidly, chemical affinity between the iron and its constituents is so to speak weakened, the oxygen of the air is at liberty to act with greater effect, the carbon which existed in the crude iron in the combined condition is burnt, the last portions of silicium are oxidised, and good malleable iron results. If in the use of white iron a temperature could once be obtained high enough to lessen to such an extent the affinity between the metal and its carbon, as to allow the oxygen to take the latter, the conversion would succeed, but unless this elevated temperature could be imparted to it previous to its treatment with air in the converting vessel, its peculiar constitution renders this otherwise impossible. Lately in Styria and, I believe, in certain parts of England, by a lengthened treatment in "the converter" with highly pressed air, pig irons resembling IV. (in the table) in composition, containing a small quantity of graphite, have been manufactured into an inferior kind of steel.

Chemists are generally of the opinion that the quality of Bessemer steel is strongly influenced by the amount of silicium contained in the raw iron from which it was derived, and Phipson+ sought to prove that in pig irons

+ *Comptes Rendus*, t. lx. p. 1030.

which may be successfully used in the making of steel, the silicium must, like the carbon, exist in the free state. The means by which he arrived at this conclusion were somewhat peculiar, and I was induced to make some experiments on the subject, an account of which I published. Phipson† had examined three varieties of iron, A, B and C, in which he found the silicium to exist as under:—

	A	B	C
Combined silicium or Siα	98	1·81	2 60
Graphitoidal silicium or Siβ	3·22	2·15	1·63
	4·20	3·96	4·23

Because A contained its silicium principally in the free state, and C for the most part combined, they yielded respectively good and bad steels. In order to detect this graphitoidal silicium, I dissolved about 20 grammes of iron I. (in the table of analyses, which ranks highest among steel makers), in dilute hydrochloric acid, collected the insoluble matter, and burned it in oxygen. The residue was evaporated to dryness twice with hydrofluoric acid to remove silica, and afterwards heated with strong hydrochloric acid to remove a small quantity of oxide of iron. After this treatment I obtained a very small quantity of a light brown substance which displayed none of the physical properties of graphitoidal silicium under the microscope, but which proved to be titanic acid. Had free silicium been present I should have detected it.

To estimate the two modifications of silicium, Dr. Phipson treated a weighed quantity of the iron with aqua regia, the resulting silica from Siα was dissolved by the acid, while that from Siβ was insoluble. It is a well established scientific fact, that any variety of silicium which has once been exposed to a red heat (as Siβ in iron must certainly have been) is quite unaffected by aqua regia—enough in itself to show how little this process is to be relied on.

To see if the amount of insoluble silica was a constant quantity I made the following three experiments.

I. 2·409 grms. of iron dissolved in aqua regia ($3HCl+NO_6H$) gave 0·0565 grm. $SiO_2=1·094$ per cent silicium.

II. 2·39575 grms. of iron in a large excess of aqua regia gave 0·038 grm. $SiO_2=0·74$ per cent silicium.

III. 2·336 grms. of iron, dissolved in aqua regia, and most of the acid carefully boiled off before filtering, gave, 0·06775 grm. $SiO_2=1·353$ per cent silicium.

As might be expected, the amount of insoluble silica varies with the quantity of acid employed; thus in II., where much acid was used, the quantity of silica is only about ½ of that in III., where, previous to filtration, most of the acid was boiled off.

In what I took as a reply to my communication of these experiments, Dr. Phipson‡ stated that what he at first looked upon as free silicium in pig iron, occurred, he had more recently found, as silicic acid combined with protoxide of iron. Now if we are to consider the 3·22 of Siβ (given in Dr. Phipson's estimations), as present in the state of silicic acid saturated with protoxide of iron, we arrive at the astounding discovery that this iron contains 23·46 per cent of slag. Few chemists would accept this statement without strong evidences of its truth. To ascertain whether this position were tenable, I heated 3 to 4 grammes of Cleator iron (I.) in a stream of perfectly dry chlorine; all iron and silicium are volatilised as chlorides, while silica, if present, remains unaffected. The carbon burnt off in oxygen. I obtained a small residue, mostly titanic acid, weighing only 1 or 2 milligrammes, equal to 0·3 per cent, instead of 6 or 7 per cent, as Dr. Phipson would show.

From his experiments, by a course of reasoning upon which we have no enlightenment. Dr. P. infers that only Siα, and not Siβ, exerts a deleterious action in the conversion of iron into steel. If, however, we have shown his assumption that SiB exists in pig iron is groundless, no correct conclusions can be drawn from the data which he has given, and until our information is more definite, the subject must remain where it is.

The presence of graphitoidal silicium in iron, though believed possible by many metallurgists, has, as far as I know, never been clearly shown. Percy† thinks its existence highly probable, and Büchner ‡ makes a statement to the same effect, but neither seem to have made any special experiments on the subject. Hahn § prepared a silicide of iron containing as much as 20·29 per cent silicium. By treatment of this substance with hydrofluoric acid, a small crystalline residue remained undissolved, which proved to be a definite compound $FeSi_2$. Even with this enormous percentage of silicium none of that element separated in the free state. In the preparation of this compound only pure materials of known composition were used, and it may be urged that in the presence of the numerous substances which make up the constitution of crude iron, its behaviour might be modified. Caron‖ a high authority in these matters, distinctly states that silicium never can exist in the uncombined state in iron, and that on account of its superior affinity it expels most other elements from combination.

Although altogether disagreeing with Dr. Phipson's conclusions, or more exactly with the way in which he arrives at them, I believe it quite possible that silicium may exist variously combined in pig iron, and as it occurs in one manner or another (as yet undefined) may exert a more or less deleterious action upon the steel made from it. I look upon it nevertheless, as a fact, that an iron tolerably rich in silicium, may be converted into good steel, although it contains neither graphitoidal silicium nor silicate of protoxide of iron.

(To be continued.)

† Chemical News, No. 330.
‡ *Comptes Rendus*, t. lxii. p. 803.

A PRELIMINARY NOTICE OF

THE AKAZGA ORDEAL OF WEST AFRICA,

AND OF ITS ACTIVE PRINCIPLE.

By THOMAS R. FRASER, M.D.

This ordeal poison is referred to in the works of Du Chaillu* and Winwood Reade;† and several of its toxic properties have been described by MM. Pecholier et Saint-pierre.‡ A few specimens were sent to this country in 1864 by the Rev. A. Bushnell of Baraka, and these were very kindly given to the author by Mr. Thomson of Glasgow; and a further supply came from the same quarter in 1865. These gentlemen, and Dr. Nassau of Bonita, supplied valuable and interesting information regarding its employment.

The poison is known in Africa as Akazga, Boundon (or M'Boundou), Ikaja, and Quai; Akazga being probably derived from *nkazga*, which signifies pain or hurt. It is used as an ordeal for the detection of real and superstitious crimes on the West Coast of Africa, in a large district which extends north and south of the equator, and many miles inland, and also in the adjacent island of Corsica. It is believed that several thousand persons are annually subjected to this method of trial, and that the fatal cases are about 50 per cent.

The Akazga arrived in bundles, which consisted of long, slender, and crooked stems, having their roots generally attached to them, but sometimes their leaf-bearing

† "Metall. Iron and Steel."
‡ *Journ. f. prakt. Chemie*, bd. 72, p. 364.
§ *Ann. d. Chem. u. Pharm.*, cxxix. p. 57.
‖ "Memoire sur les Aciers."

* Explorations and Adventures in Equatorial Africa 1861.
† Savage Africa, 1862.
‡ *Comptes Rendus*, 1866, p. 809.

branches only, and containing also a very few complete plants, with roots, stem, and branches. The plant is usually about six feet in length; but some specimens were only four, and others as long as eight feet. The bark is yellowish orange, and in some parts light red, and it is frequently covered with a gray efflorescence. It adheres firmly to the stem, but may be readily detached, after exposure to a gentle heat for some days. Its internal surface is light brown. The space between the bark and the wood was found, in a few pieces, to be occupied by a large number of minute sparkling crystals; but it has not yet been determined whether these consist of a vegetable or mineral substance. The leaves are opposite and oval-accuminate in form; the apex frequently consisting of a linear prolongation more than an inch in length. From its general characters, the plant is supposed to belong to the Loganiaceæ, but the materials are insufficient to identify it.

By boiling the powdered bark with alcohol of 85 per cent, and distilling and evaporating the tincture, a brown shining extract is procured, weighing from 12 to 15 per cent of the bark employed. It has a bitter, non-persistent taste, and, when treated with concentrated nitric acid, produces a brownish-yellow colour, which is not materially affected by heat, nor by solution of proto-chloride of tin. It is obvious that the active principle of Akazga is contained in this extract; and to separate it the following method has been adopted, after several attempts with various processes:—The extract is treated with a very dilute solution of tartaric acid, which removes 77 per cent, and filtered. The clear, yellowish-brown acid solution is shaken with successive portions of ether, so long as any colour is removed; and by this means also a small quantity of an aromatic oil is separated from it. After decantation, a solution of carbonate of sodium is added to the liquor, so long as it causes a nearly colourless, flocculent precipitate. It is again shaken with ether, which is decanted, and agitated with three successive portions of distilled water, and finally received in a bottle containing a dilute solution of tartaric acid, and shaken with it. As soon as the etherial solution is brought in contact with the acid, it becomes opalescent, but again assumes its normal appearance on agitation. This change is of some value, as indicating the frequency with which the alkaline solution should be treated with ether, as the milkiness, on contact with tartaric acid, is not produced when the former is exhausted. On reaching this stage the tartaric solution is exposed to a gentle heat—to free it completely from ether—filtered, and again treated with carbonate of sodium, by means of which a bulky, colourless, and flocculent precipitate is obtained. This is collected in a filter, washed, and dried, by exposure to a gentle heat for a short time, and then by the action of sulphuric acid *in vacuo*.

By this means a colourless, amorphous substance is obtained, which is the active principle of the Akazga poison, and which possesses the general properties of a vegetable alkaloid. About 10 grains may be separated from 500 grains of the powdered stem-bark, or 2 per cent. *Akazgia* is proposed as its name; and it is hoped that when the plant is described, if it has been previously unknown to science, Akazga will be adopted as its specific name, and thus the usual connection of nomenclature between the vegetable alkaloid and its source will be maintained.

Akazgia is soluble in about 60 parts of cold absolute alcohol; in about 16 parts of spirit, of 85 per cent; in about 120 parts of anhydrous sulphuric ether; and in 13,000 parts of distilled water, at a temperature of 60° F. It is freely soluble in chloroform, in bisulphide of carbon, in benzole, and in sulphuric ether of specific gravity 0·735. It crystallises with difficulty, but it may be obtained in the form of minute prisms, by the slow evaporation of a solution in rectified spirit. An analysis of its platinum-salt, and a determination of its combining proportion with dry hydrochloric acid, yielded 290 in the former, and 293 in the latter, as the equivalent of Akazgia. When heated it becomes yellow, then melts, and gives off fumes of a pungent, disagreeable odour, and finally becomes charred, but leaves almost no residue if the heat be continued for a sufficient time. Its solutions have an alkaline reaction, and neutralise acids; and the salts are freely soluble in water, and have a very bitter, non-persistent taste. Concentrated nitric, hydrochloric, and sulphuric acids change its colour to brown, but these in a diluted state, as well as many of the organic acids, form pale, yellowish solutions with Akazgia. It is precipitated from these solutions by hydrate, carbonate, and bicarbonate of sodium, and of potassium; by iodide, sulphocyanate, ferrocyanide, and chromate of potassium; by phosphate of sodium, proto-chloride of tin, trichloride of gold, dichloride of platinum, potassio-mercuric-iodide, carbazotic acid, tincture of galls, solution of iodine, and various other substances, *but these precipitates are never crystalline*. Corrosive sublimate causes an amorphous white precipitate, which is dissolved by heat, and reappears in a non-crystalline form when the solution has cooled. Chlorine produces an amorphous, colourless precipitate, which does not disappear on the addition of ammonia. With concentrated sulphuric acid, and peroxide of manganese, bichromate of potassium, or any other of the usual oxidising agents, the same succession of colours is produced, from blue to brown, which results from a similar treatment of strychnia.

The alcoholic extract of Akazga possesses physiological properties very similar to those of nux vomica; and comparative experiments were detailed, to show that the active principle, Akazgia, has exactly the same actions as the extract, and a proportional activity to it.

There are several instances in which a Natural Order produces several very similar active principles. In the Loganiaceæ itself, strychnia, brucia, and igasuria already exist, and these are nearly identical in their physiological actions. In chemical properties, brucia and igasuria have much in common, and they are both readily distinguishable, in this respect, from strychnia. Akazgia conveniently completes this group, as its chemical properties are nearly allied to those of strychnia, whilst its connection with all the members is maintained by the similarity of its physiological actions.—*Proceedings of the Royal Society of Edinburgh, Session* 1866-67.

BRITISH PHARMACEUTICAL CONFERENCE,

FOURTH ANNUAL MEETING, AT DUNDEE,

President—PROFESSOR BENTLEY, M.L.S., M.R.C.S., &c.

(Continued from page 192.)

"*On Granular Charcoal.*"

By WENTWORTH LASCELLES SCOTT, F.C.S., &c.

For some years past the value of charcoal, for internal use, has been gradually more and more recognised, and probably it would have been employed to a still greater extent, but for some little difficulties in the way of its convenient administration.

I may truthfully claim the originality and priority as regards granular charcoal, as it is now many years since my first experiments were made with this preparation, with the kind assistance of my friend the late Mr. Frank B. Fowler.

Granular charcoal has the several advantages of being a definite preparation, easy of administration, and not liable to alter by keeping.

I prefer to use box, willow, or lime-tree wood for conversion into charcoals for medical purposes, merely on account of their texture and absorptive powers; and the

carbonised matters, when free from all volatile substances, should be cooled out of contact with air, and boiled for some time in a dilute solution of hydrochloric acid, followed, after copious washings with pure distilled water, by a little weak ammonia.

The dried fragments of charcoal thus purified are then ready for a second ignition, which may be effected in tubes, cylinders, or retorts of metal or porcelain; after which, and before they are cold, they must be quickly pulverised and passed through a sieve of from 80 to 100 apertures to the inch.

Nine pounds of this finely-divided carbon may then be intimately mixed with one pound of pure sugar (which has been passed through a No. 30 sieve), and about four ounces of arabine or gum acacia in the state of impalpable powder. The whole should next be slightly moistened, by means of an Atkinson's diffuser, or other similar instrument, with a few ounces of warm distilled water, to which has been added about 1¼ ounces of tincture of benzoin, and a little mucilage; it is then ready for granulation, which is effected upon a flat steam-pan in the usual manner, at a temperature of 215° to 225°; a little extra care and attention should be given to the manipulation in granulating charcoal, as compared with other preparations; an additional rolling kind of action being required, which is readily learnt after a few trials.

The charcoal should be sifted when perfectly dry, and while yet warm, and secured in well-stopped bottles or jars. I would recommend sieves of Nos. 6 and 16 gauze respectively.

Granular charcoal, when properly made, should possess a hard compact structure, and a sweet and slightly aromatic taste; it should not soil the fingers when dry, but must disintegrate very quickly without exhibiting any gritty particles in the presence of moisture.; further, its integral porosity is by no means destroyed, as good granular charcoal may absorb fully eight and a half times its volume of sulphuretted hydrogen at ordinary temperatures, and proportionate quantities of other gases.

It is to this very property of the absorption or liquefaction of gases by charcoal, that I wish to draw your attention for a few moments. We all know that upon this alone, or very nearly so, depends the value of charcoal as a disinfectant and as an oxidiser, in whatever way it be employed, and we are very generally acquainted with the fact, that its power of taking up many of the easily liquefied or more soluble gases is very great indeed. As an instance, take ammoniacal gas; in the generality of scientific manuals and text-books some notice is taken of this, but in very loose terms, the amount of absorption being variously given up to "about ninety times the volume" of the charcoal itself, while my own experiments show that charcoal is capable of absorbing no less than 122 volumes of ammonia.

Now, putting aside certain collateral points for the moment, we may state generally that charcoal is taken internally, for the purpose of absorbing and masking the action of any acidulous and soluble gases that may be present in excess, thereby preventing or greatly diminishing their injurious action. Granting its usefulness in this respect, the question immediately arises, why not sometimes reverse the proposition? Why should not charcoal be made the carrier of gaseous bodies suited for the treatment of certain forms of disease, but which, under all ordinary methods, are either impossible or very difficult to administer?

My late experiments have been directed towards this question, and I am decidedly of opinion that charcoal, saturated with various gases, may hereafter become useful remedial agents. The subject is naturally one which cannot be treated lightly, and which requires some extended and patient labour for its proper development; but as far as I have already gone, the results are, in my opinion, most encouraging.

"*Analysis of Ordinary Commercial Specimens of Jalap, showing their relative Value in proportion of Resin of Jalap compared with market price.*"

By Mr. Alfred Southall, Birmingham.

Description.		Resin.	Market Price.
No. 1 ..	Jalap tops ..	5 per cent ..	4*d.* per lb.
,, 2 ..	,, ..	12 ,, ..	5*d.* ,,
,, 3 ..	,, Tampico	9½ ,, ..	10*d.* ,,
,, 4 ..	,, ,,	10½ ,, ..	1*s.* 0*d.* ,,
,, 5 ..	,, ,,	30¼ ,, ..	1*s.* 0*d.* ,,
,, 6 ..	,, ,,	29 ,, ..	1*s.* 6*d.* ,,
,, 7 ..	,, ,,	12½ ,, ..	1*s.* 6*d.* ,,
,, 8 ..	,, ,,	33¾ ,, ..	2*s.* 0*d.* ,,
,, 9 ..	,, ,,	27 ,, ..	2*s.* 0*d.* ,,
,, 10 ..	,, Vera Cruz	15½ ,, ..	4*s.* 0*d.* ,,
,, 11 ..	,, ,,	17½ ,, ..	4*s.* 0*d.* ,,
,, 12 ..	,, ,,	17¼ ,, ..	4*s.* 0*d.* ,,
,, 13 ..	,, ,,	12½ ,, ..	4*s.* 0*d.* ,,
,, 14 ..	,, ,,	23 ,, ..	4*s.* 4*d.* ,,
,, 15 ..	,, ,,	20¼ ,, ..4	*s.* 6*d.* ,,
,, 16 ..	,, ,,	16¾ ,, ..	4*s.* 10*d.* ,,

In order to ascertain the medicinal value of the supplies of jalap, as found in the shops of pharmaceutists, I procured five specimens of powdered jalap at different establishments, and found the result, in per centage of resin, as follows:—

No. 1, 13 per cent of resin.
,, 2, 15 ,, ,,
,, 3, 9½ ,, ,,
,, 4, 16½ ,, ,,
,, 5, 17 ,, ,,

The commercial value of jalap imported from Tampico is much inferior to the kind imported by way of Vera Cruz, but an average of seven samples of each kind here analysed, show that the Tampico is richer in resin than the Vera Cruz; the average in the one case being about 22 per cent, and in the other 17¼ per cent.

I have made an experiment with the purgative effects of the two varieties, and find them much the same. The resin from Tampico jalap is somewhat darker than that from the Vera Cruz variety, and has a distinctive peculiarity of smell, but I have not discovered any difference in chemical character.

REPORTS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, October 1st, 1867.

EDWARD SCHUNCK, Ph.D., F.R.S., &c., President, in the chair

Dr. Crompton, alluding to the paper he read in October, 1866, "On the Portraits of Sir Isaac Newton," said, that while preparing his essay for publication in the Memoirs of the Society, he had opened up fresh sources of information, and become possessed of facts of considerable interest respecting the portraits of Newton. He had examined about twenty portraits of the great philosopher, all of which were considered to be originals, and most of which were undoubtedly painted a long time ago; but he had seen no portrait which, in his opinion, was of equal importance and interest with the Kneller Newton of 1689, to which he last year directed the attention of the Society, as by far the most valuable portrait of the great philosopher in existence, and of which he exhibited an admirable engraving by Mr. Oldham Barlow. His extended inquiries into the subject of the portraits of Newton had led him to the conclusion that there are several (if not many) which pass current as portraits of him which are most decidedly

representations of other persons. In the National Portrait Exhibition at Kensington of the present year there were four portraits of Newton, two of which he feels sure have no real claim to be regarded as authentic or genuine. These two are pictures contributed by the Earl of Dartrey and by the Marquis of Exeter. The former purports to be a portrait of Newton when he was a Bachelor of Arts, and to be painted by Lely. It represents a young man with his hand resting on a globe; and there is an engraving of the picture, done many years back, but he had no hesitation in saying that the picture had no right to be considered a portrait of Newton. The features were not Newton's, and it was most improbable that the poor Trinity College Sizar would, when a Bachelor of Arts (that is, between January, 1665, and July 7, 1668) have cared, or, if he had cared, could have had the means to obtain a portrait of himself. He apprehended that because the portrait represented a young man with his hand on a globe, some imaginative person had supposed that it must be a representation of the great philosopher who had explained the system of the universe. But this portrait represents one of the poorest specimens of humanity; and certainly not a Newton, but rather a Simple Simon. The Marquis of Exeter's picture has hardly any greater claim to be regarded as a Newton. It represents a man with a bald head, but we have the clearest evidence that Newton was not bald.* The two Vanderbank portraits, representing him the year before his death without his wig, show that he had a beautiful head of silver white hair. There is another portrait of Newton by Thornhill, taken at an earlier period, which represents him without his wig, but with short white hair and no trace of baldness. The Portsmouth Kneller of 1689, which represents him when he was 47 years old, shows him without a wig and with abundant grey hair. This is a sufficient ground for rejecting this picture; but no one who has studied the portraits of Newton could be brought to believe that this is a representation of the great philosopher. Last year when reading his paper, Dr. Crompton remarked that he had been unable to discover where the original Kneller of Newton, engraved by Houbraken, was to be found. He then pointed out that in some impressions of the Houbraken print it was stated to be in the possession of Mr. Conduit. Dr. Crompton went to the Earl of Portsmouth's seat at Hurstbourne Park, and there found the original picture. It is dated 1702 and signed by Kneller. The Earl of Portsmouth, Newton's collateral descendant, therefore possesses the two most important portraits of Newton. This portrait of Newton was engraved also by Smith, about 1712. A replica, if not an earlier copy, without any name of an artist upon it, is in possession of the Duke of Devonshire at Holker. His Grace informs me that he cannot positively trace its coming into the possession of his family, but he conjectures that it may have been at Holker before the marriage of one of the Lowthers with Lady Mary Cavendish, through whom this Holker property passed to the Cavendishes. There is an exact replica or early copy of the Portsmouth Kneller of 1689 at Lord Galway's, except in not having the name of Newton or of Kneller upon it, which Dr. Crompton has examined, and which, in an old catalogue of the pictures, is said to be painted by Bond. Dr. Crompton said that he had examined the three oil paintings of Newton in the Royal Society's collection; also the Kneller at Hampton Court, which is dated 1689, and differs from the Portsmouth Kneller of 1689 only in the position of the hands; also all the portraits of Newton belonging to Trinity College, Cambridge; the Indian ink drawing of Newton in the Pepysian library at Magdalen College; and a portrait at Mrs. Miles', at Firbeck Hall, Yorkshire, which resembles very much the Egremont Newton by Kneller, engraved as a frontispiece to Sir David Brewster's first life of Newton, published in the Family Library. Dr. Crompton exhibited this edition of Brewster's life, as well as the larger one in two vols. In the text of both the engravings, which differ very greatly from each other, are said to be from a picture in the possession of Lord Egremont. Sir David Brewster is unable to explain how it is that two engravings from distinct and different portraits should thus happen to be spoken of in the text, except that his publisher must have selected the second portrait and got it engraved. It is, I think, unmistakeably taken from Smith's print of 1712 or an early impression of Houbraken's engraving. The portrait prefixed to the small Life of Newton is the same as that engraved in Lodge's portraits. At present Dr. Crompton is unacquainted with the historical evidence regarding the genuineness of this portrait. It is signed by Kneller and dated 1716; but Dr. Crompton has not yet seen it, nor one in the possession of Mr. Turner, of Stoke Ashford, near Grantham.

In Lord Portsmouth's collection at Hurstbourne, besides three genuine and authentic portraits of Newton, there is a fourth picture with the name of Newton painted upon it. It was described to Dr. Crompton by a gentleman who had had an opportunity of a very close examination of it, as the earliest and most important portrait of the great philosopher. But Dr. Crompton found neither date nor artist's name upon it, and the picture, which is mounted upon panel, has a crest in red wax behind it, which is not the crest of the Portsmouth family, but could not be sufficiently determined what it was for want of a magnifying glass. The history of this picture will be investigated further; though it is certain that it cannot be a portrait of Newton, for the features are not his, and the eyes are brown, while Newton's were bluish grey. It is most earnestly to be desired that all the portraits of Newton might be collected together at Kensington next year for comparison with each other, and that the portraits of other great men (where there are several) should be thus exhibited in juxtaposition. It would probably then be evident that there exist many spurious ones, and an opportunity would be thus afforded of determining which are the best as well as the true.

Mr. R. D. Darbishire, F.G.S., referred to a paper "On the Existence of a Seabeach on the Limestone Moors near Buxton." (*Trans. Manchester Geol. Soc.*, v. p. 273), in which Mr. John Plant, F.G.S., had described as sea beach the surface of the limestone rock as the same is seen when bared of sward and surface clay above the quarries on Grin Edge and Harper Hill, south-west of Buxton, and to Mr. Plant's conjecture that this worn surface probably extended nearly to the crown of the hills.

His own observation had marked on each hill, above the stratum whose upper surface exhibited those indications of wear, a stratum of somewhat different texture still subsisting in the shape of a slight vertical cliff or reef. This bed had not worn in the same manner as the "beach," that is to say, with many interlacing fissures having a close *chevaux de frize* of limestone points, but rather in great blocks with round, curved edges or holes.

In connection with this bed, Mr. Darbishire had obtained specimens from each hill exhibiting what he believed to be the remains of the burrows of Pholas shells.

On the top level of Grin Edge, close to the ruins of the tower, one stone had a group of seven holes. They were placed like Pholas holes as he had collected them on Great Orme's Head; and, though the surface of the stone about them was much worn, taken along with the specimen next described, it seemed more fitting to ascribe to them a similar origin than to attribute them to the natural wear of the stone, notwithstanding the variety and singularity of many of the forms in which atmospheric or aqueous corrosion affect the limestone rock.

This stone lay amongst a heap of others near the ruins of the tower, and had doubtless been brought up a few feet. The height above the sea of the tower is stated on the Ordnance Map as 1,435 feet.

* Mr. Conduit, Newton's nephew by marriage, when describing Newton's personal appearance, says, "With a fine head of hair as white as silver, without any baldness, and when his peruke was off, was a venerable sight."—Brewster's *Life of Newton*, 1855, vol. ii., p. 413.

On Harper Hill, in two large blocks of the overlying stratum, he had detected more characteristic holes. Both blocks were lying in the sward above the "beach" surface, and were a few feet below the rock *in situ*, from which they had evidently been detached. Of the first of these specimens he exhibited a photograph. It showed in the under side of the edge of a projecting ledge or table of stone six well marked holes from ¾ in. to 1 in. in diameter, and one an inch deep, and traces of two others. The holes were grouped just as Pholas holes usually are, and apparently were quite independent of the structural fissures of the stone.

According to measurement with an aneroid barometer, the stone in which those holes occurred was about 1,380, and the reef from which it had fallen about 1,400 feet in elevation.

If the holes were really Pholas burrows, they would indicate the elevation of these hills since the period of glacial action by sea or land.

Mr. Binney, F.R.S., F.G.S., remarked on the great elevation of these remains if the observations were accurate, and observed that they were on the west side of the hills. Mr. Prestwich had discovered shells in shingle on the western slopes of the Axe-edge hills towards Macclesfield, at the height of 1,150 feet. He would like to hear of observations on the eastern side of the Derbyshire hills if any traces of marine action were to be discovered there.

Mr. Darbishire had not the specimens at hand, but would produce them, in connection with a series of similar remains from Orme's Head, to which he proposed to call the attention of the Society at an early meeting.

ACADEMY OF SCIENCES.

October 14, 1867.

(From our own Correspondent.)

Lever Barometer—New Mountain Barometer—Solar and Lunar Halos and Coronæ—The Pascal-Newton Forgeries—Solar Spots—Water Conduits.

The discussion between M. Radau and the Rev. Father Secchi on the lever barometer is not yet terminated. At the last meeting, M. Secchi tried to prove that the barometer did not require any thermometric corrections. M. Radau now affirms that Father Secchi, in his demonstration, has confounded the dilations produced by 10° with those produced by 1°C; the consequence is that the calculated numbers are false. In reality the error of the barometer is more than a millimètre for 10°, instead of being the hundreth part of a millimètre, as M. Secchi affirms.

M. F. de Bruno, Professor at the University of Turin, presented a barometer formed of two or three concentric tubes of glass or cast iron—a sort of lever barometer which possesses the considerable advantage of being able to be transported without great danger of rupture, or the loss of the vacuum. His idea is simple and ingenious.

M. A. Decharme, Professor at the Imperial Lyceum of Angers, observes with much care the great and small solar and lunar halos and coronæ; he has ascertained that—1st. At Angers these meteoric phenomena are more frequent than is generally believed. From the 30th August, 1866, to 30th August, 1867, he had observed 33. 2nd. In all cases they were followed by rain or snow on the same day, the day following, or, at latest, on the next day for a very small number. 3rd. That in general the rain is the nearer and more abundant in proportion to the brilliancy of the phenomenon. The study of halos can thus furnish precious indications as prognostics of the weather.

M. Faugère writes to the Academy a letter truly incredible; also a comparison of Pascal's notes with the only page of the illustrious philosopher which was at his disposition, and has very roughly concluded the falsity of all the documents of M. Chasles. At present the comparison of a letter of King James, kindly placed in his hands by M. Chasles, with the fac-simile of a similar letter found by him in a printed work, he declares apocryphal to the letters of M. Chasles. He does not even remark, as M. Morin observes, that often the letters of sovereigns are neither written nor signed by them, and that they are not the less authentic documents. He asks simply that all the autographs of M. Chasles be submitted to an enquiry confided to the direction of the Imperial Printing Establishment, and to the most learned connoisseurs of its administration. M. Chasles declares formally that he denies the competence of M. Taschereau, whose ability in discernment of autographs appears to him to be doubtful; that he is disposed to publish the entire collection of these documents. Meanwhile he places them at the disposition of all those who wish to consult them, but that they shall not leave his possession. He remarked that this enquiry has been already made, for several of the most important pieces with those of the British Museum, the Royal Society of London, by many amateurs, by the aid of a fac-simile taken from the most authentic autographs, and the comparisons have successfully overruled all the objections put forward. M. Chasles reverted also to the origin of his autographs; he thinks that he can satisfy to all purposes the indiscreet questions that have been put to him in affirming that they formed part of the collection of Desmaizeau. He is convinced that by indicating the series of hands through which they passed into his own, no step would be gained as to proving their authenticity. Seven portfolios of the same collection—that of Desmaizeau—have remained in London, where he died, and which may be found in the British Museum or elsewhere by proper search, which will serve to demonstrate most forcibly the authenticity of the last portfolio remaining in France, for the possession of which English amateurs have made vain endeavours since the death of Desmaizeau. It seems to us that he can say nothing more explicit; and the search for the portfolios of Desmaizeau, is the only reasonable way of putting an end to this painful discussion. Let the Royal Society of London order a commission of its members to examine seriously the autographs in the possession of M. Chasles. We repeat that the falsifying of these thousands of documents is an utter impossibility. And the fact that the pretended forger makes the relations between Newton and Pascal date as far back as the time when Newton was only 14 years old, is in itself a convincing proof of their authenticity.

M. Le Verrier made a discourse in which he tried to demonstrate, in the most positive manner. the false origin of the astronomical documents attributed to Pascal. The President, and the Secretary, M. Eli ede Beaumont, begged of him to reserve his proofs for the commission, to which was referred the proposition of M. Faugère. M. Le Verrier insisted on being heard by the Academy, inasmuch as that the overwhelming proofs in his possession, will arrive soon from England; but the language of M. Le Verrier was so far from being academical, and so injurious to M. Chasles, that it was received with marked signs of disapprobation by the whole assembly. M. Saint Claire Deville read a letter, in which M. Kirchhoff answered to a question made by M. Chasles, as to his theory of solar spots.

Father Secchi read a paper on the admirable water conduits made in the Roman Compagna with full success.

Volatility of Sesquichloride of Iron at Common Temperatures.—When sesquichloride of iron is rendered very acid by hydrochloric acid, the vapour therefrom colours a solution of sulphocyanide of potassium faintly red, when allowed to impinge upon it for a short time.—*William Skey, New Zealand.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Benzylic Ether, Nitro-derivatives of.—Ed. Grimaux. Nitrobenzoylic hydride dissolves in alcoholic potassic hydrate, with formation of potassic nitrobenzoate, and an oil which probably is nitrobenzylic alcohol. The reaction takes place in the following manner:—

$$2[C_7H_5(NO_2)O]+KHO=$$
$$=C_7H_4(NO_2)O_2K+C_7H_7(NO_2)O.$$

This oil cannot be distilled at ordinary pressure without undergoing decomposition; in a vacuum it boils between 178° and 180°C. Phosphoric chloride converts it into nitrodracethylic chloride (the nitrobenzylic chloride of Beilstein and Geitner, *Ann. Chem. Pharm.* cxxxix. 337), which, on being boiled with an alcoholic solution of potassic acetate, forms the ether $C_6H_4(NO_2)CH_2(C_2H_3O_2)$.—(*Comptes R.* lxv. 211.)

Orcin, Methyl-, Ethyl-, and Amyl-derivatives of.—V. de Luynes and A. Lionet. The action of alcohol-iodides and potassic hydrate upon orcin gives rise to the formation of three series of compounds, in which, according to the conditions of the experiment, one, two, or three atoms of hydrogen of orcin are replaced by alcohol-radicals. The authors have prepared by this method—

1. Methyl-orcin, $C_7H_7(CH_3)O_2$,
   ethyl-orcin, $C_7H_7(C_2H_5)O_2$,
   and amyl-orcin, $C_7H_7(C_5H_{11})O_2$.
2. Diethyl-orcin, $C_7H_6(C_2H_5)_2O_2$,
   and diamyl-orcin, $C_7H_6(C_5H_{11})_2O_2$.
3. Trimethyl-orcin, $C_7H_5(CH_3)_3O_2$,
   triethyl-orcin, $C_7H_5(C_2H_5)_3O_2$,
   and triamyl-orcin, $C_7H_5(C_5H_{11})O_2$.

—(*Comptes Rendus*, lxv. 213.)

Glycolic Hydriodate, and New Synthesis of Alcohols.—A. Butlerow and M. Osokin. Glycolic hydriodate (iodhydrin) C_2H_5IO is readily formed by the action of potassic iodide upon glycolic hydrochlorate; potassic chloride and iodide are extracted from the mixture by water; the remaining oil is washed first with a solution of sodic hydrate, then with water, and finally dried over dehydrated sodic sulphate, and distilled in a vacuum. Iodhydrin is energetically acted upon by zincic methide or ethide, and if water is added to the product of the reaction, iodhydrin is again formed, besides hydrocarbons:

$$\left.\begin{matrix}C_2H_4I\\RZn\end{matrix}\right\}O+2H_2O=C_2H_5IO+RH+ZnH_2O_2$$

If, however, certain conditions are observed during the reaction, the alcohols C_3H_8O and $C_4H_{10}O$ may be obtained.—(*Zeitschr. Chem.* N.F. iii. 369.)

Acetonic and Oxyisobutyric Acid.—Markownicoff has prepared acetonic acid according to Städeler's method, and compared it with oxyisobutyric acid. He finds that they agree as regards the temperature required for their sublimation (50°C.) and fusion (79°—80°), and that their characteristic zinc-salts show the same properties. From these experiments, and others published on a former occasion (Zeitschr. ii. 502), the author concludes that Frankland's dimethoxalic acid, Städeler's acetonic acid, and his oxyisobutyric acid, first obtained from monobromisobutyric acid, are identical.—(*Zeitschr. Chem.* N.F. iii. 434.)

Sulphophenyle.—C. G. Wheeler. By the reduction of phenylsulphonic chloride by means of zinc and sulphuric acid, phenylic sulphydrate and phenylic bisulphide are formed. On dissolving the mixture of the two in warm alcohol, the bisulphide is obtained in crystals, while the oily sulphydrate remains in solution. Bromine acts readily upon phenylic bisulphide, forming a crystalline body of the composition C_6H_5BrS, which is readily soluble in ether, moderately so in alcohol, insoluble in water. The author intends to convert this bromide into a cyanide, which on being treated with potassic hydrate is expected to yield an acid corresponding to oxybenzoic acid, and identical, perhaps, with the acid obtained from potassic sulphhydrate and chlorbenzoic acid. The reaction would be the following:—

$$\left.\begin{matrix}C_6H_5\\CN\end{matrix}\right\}S+KOH+H_2O=H_3N+(C_6H_5S)CO.OK.$$

(*Zeitschr. Chem.* N.F. iii. 436.)

Benzyl-Amides.—H. Limpricht. The action of alcoholic ammonia upon chlorbenzyl gives rise to the formation of mono-, di-, and tri-benzylamine, which may easily be separated by converting them into hydrochlorates and subjecting the latter to fractional crystallisation.

Tri-benzylamine crystallises in large plates; it may be distilled in small quantities at above 300°C. without undergoing decomposition. The chlorhydrate, heated in an atmosphere of dry chlorhydric acid to 250°C., is resolved into chlorbenzyl and dibenzylaminic chlorhydrate:

$$(C_7H_7)_3N,HCl+HCl=C_7H_7Cl+(C_7H_7)_2HN,HCl.$$

The free base, when distilled with bromine and water, gives oil of bitter almonds and bromhydrate of dibenzylamine:

$$(C_7H_7)_3N+Br_2+H_2O=C_7H_6O+(C_7H_7)_2HN,HBr+HBr$$

A similar reaction takes place when heated with iodine and water in sealed tubes to 120°. Dry bromine added to an etheric solution of tribenzylamine precipitates an amorphous yellow body of the composition $(C_{21}H_{21}N)_2Br_6$. Fuming sulphuric acid converts tribenzylamine into a sulpho-acid, the baric salt of which has the formula $C_{14}H_{13}NS_2O_6,Ba$.

Dibenzylamine is a thick colourless liquid, insoluble in water, readily soluble in alcohol or ether. It forms well crystallisable salts with chlor-, brom-, and iodhydric acid, which are soluble in hot water, sparingly so in cold.

Monobenzylamine awaits further investigation, not having been obtained in sufficient quantity.—(*Zeitschr. Chem.* N.F. iii. 449.)

Hippuric Acid, Synthesis of.—N. Iazukowitsch. The reaction by which sarcosine (methl-glycocyne) is formed (acting upon chloroacetic acid with methylamine) may be employed for the synthesis of hippuric acid (benzoyl-glycocyne), using benzamid instead of methylamine:

$$C_2H_3ClO_2+N\left\{\begin{matrix}CH_3\\H_2\end{matrix}\right.=C_2H_3N\left\{\begin{matrix}CH_3\\H\end{matrix}\right.O_2+HCl$$

Sarcosine

$$C_2H_3ClO_2+N\left\{\begin{matrix}C_7H_5O\\H_2\end{matrix}\right.=C_2H_3N\left\{\begin{matrix}C_7H_5O\\H\end{matrix}\right.O_2+HCl$$

Hippuric acid.

Equivalent quantities of benzamide and chloracetic acid were heated in a sealed tube to 150°—160°C. The contents of the tube, which had become solid on cooling, were extracted with ether, the insoluble portion saturated with calcic hydrate, and the calcic salt analysed; it had the composition of calcic hippurate $2(C_9H_8NO_3).Ca+3H_2O$, the acid obtained from this salt by precipitation with chloryhydric acid, had the composition of hippuric acid, $C_9H_9NO_3$.—(*Zeitschr.* N.F. iii. 466.)

CORRESPONDENCE.

DR. CLAUS ON SUCCINIC ACID.

To the Editor of the Chemical News.

Sir,—Under the title "Claus on Succinic Acid," Mr. Church communicated in the *Laboratory* an answer to the remarks which I have made, concerning his experiments on the action of nascent hydrogen on oxalic and succinic acids. I am sorry to be forced to take notice of this reply of Mr. Church; sorry the more as the reply misrepresents what he said in his first communication; and I am forced the more as Mr. Church appears to charge *me* with such a misrepresentation.

With respect to the first point, that Mr. Church did not assert, that oxalic acid yields by reduction a substance isomeric with acetic acid—I cannot know in how far he himself lays stress upon his own examinations, and if Mr. Church said: "If the preliminary examination of these substances has conducted me to a correct conclusion, I am right in supposing the last-mentioned acid to have the formula assigned to it, we have a new isomer of acetic acid;" I must think Mr. Church himself believes that he is right in his speculations, and in this supposition I quoted Mr. Church's communication. But Mr. Church himself seems to know very well how much, or better, how little authentic his examinations are, and I now share this view with him entirely, and I promise, in the future, never more to quote any of his communications or to believe them.

The second point, that Mr. Church pretends never to have stated, "that succinic acid might be made to yield butylactic acid," is wrong, and in his citation all that he said about *this* acid is left out. Mr. Church quotes from his communication: "I have commenced a few experiments in this direction also . . . But the products," &c. What Mr. Church here leaves out and signs with the three points is verbatim as follows:—

"Succinic acid, after the prolonged and energetic action of nascent hydrogen as above described in the case of oxalic acid, suffers a similar change. I have not endeavoured to moderate the action so as to form the intermediate, or butyloxylic acid, but have pushed it to the extreme, so that butylactic acid might be obtained. The operation was performed in a retort; towards its conclusion a powerful odour, resembling that of butyric acid, was noticed in the aqueous distillate. The mixture of zinc-salts in the retort was evaporated, sulphuric acid added in excess, and the liquid shaken up with ether. From this ethereal solution (besides some unchanged succinic acid) a deliquescent acid was obtained, the properties and salts of which agreed completely with the butylactic acid of Wurtz. I have likewise submitted suberic and phthalic acids to the above described treatment, and the reactions promise interesting results." But Mr. Church's last remark: "and it would be altogether premature to express any opinion as to their composition" belongs not to the butylactic acid, but to the products of these reactions on suberic and phthalic acid.

I suppose Mr. Church never thought that his answer would come into my hands, otherwise I cannot understand how he could thus deny his own words. I do not like to discuss this behaviour of Mr. Church in your journal, but for the sake of the truth I must ask you to make this letter public.—I am, &c. A. Claus.

Freiberg, August, 1867.

*** The following is Professor Church's communication referred to in the above letter:—

"The researches of M. Claus have shown certain results contradictory, according to this chemist, of my earlier experiments. Would you permit me to deny the assertions put into my mouth by M. Claus? I will do so very briefly. (1) I did not assert that oxalic acid yields by reduction 'a substance isomeric with acetic acid.' (2) I never stated that 'succinic acid might be made to yield butylactic acid.' All my experiments were merely preliminary. and, as the following extracts from my paper * show, were not deemed by myself to be adequate proof of my anticipations.

"'If the preliminary examination of these substances has conducted me to a correct conclusion, and I am right in supposing the last-mentioned acid to have the formula assigned to it, we have a new isomer of acetic acid. . . . . .

"'It will not be unreasonable to expect corresponding results from the action of nascent hydrogen on the homologues and analogues of oxalic acid, and the acid and neutral ethers of these acids.

"'I have commenced a few experiments in this direction also. . . But the products of these reactions, obtained only within the last few hours, await further purification and analysis; and it would be altogether premature to express any opinion as to their composition.'"

"Royal Agricultural College, Cirencester, April 23, 1867."

THE SCIENCE AND ART DEPARTMENT.

To the Editor of the Chemical News.

Sir,—Since the publication of the new Directory of the Department of Science and Art, after the annual examinations of 1867, we are now in a better position to understand the intentions of the Government with respect to its masters certificated in science; perhaps therefore you will permit me to re-open a subject of interest to no inconsiderable number of your readers.

On comparing the new Directory with the old, two important contractions strike us.

I. The omission of the list of certificated masters.

II. The omission of the rules for their special examination in November, they being henceforth required to undergo the same examination as students in May.

These significant changes taken in conjunction, render the supposition not improbable that the committee of the Council of Education meditate hereafter sweeping away the distinctions of the somewhat privileged class of certificated teachers, by first inundating it with a flood of new-comers of lower qualifications, and subsequently throwing down all boundary marks.

As the new rule stands, which came into operation this year, all persons above twelve years of age who shall have obtained a first or a second class at the May examinations of students, shall be deemed qualified to receive payments on results; *i.e.*, shall receive the monetary encouragement hitherto granted to certificated masters alone; this extention admits this year (I believe) between 1,000 and 2,000 additional teachers, and in the course of three years may be expected to swell the present total number of licensed teachers (about 400) to 5,000; this number will then be found too costly for the application of the former bonuses, and the Government grant will be withdrawn.

Nor will the preceptor have cause pecuniarily for complaint, since he has been yearly warned by the department that these allowances are temporary, and may cease whenever the system, whose infancy they were intended to foster, shall have acquired self-supporting vigour. He will, if provident, like the wise steward of the parable, make provision against the day of being cast out, and will seek some more permanent and less speculative remuneration. Here his Government certificate might be a recommendation if its *prestige* were not suffered to be dimmed in the eyes of the scientific public.

On the old plan each candidate for the diploma had to pass a practical as well as a theoretical test; *e.g.*, in chemistry three hours were assigned him to analyse and describe some such unknown mixture as silica with

* *Journal Chem. Soc.*, 1864 [2], p. 301.

sulphates of baryta and magnesia. * Thus every successful master was known to have some slight acquaintance with manipulation, while a certificate of the first grade implied a certain higher degree of proficiency in qualitative analysis. For this is now substituted an examination in theory of perhaps greater difficulty, coupled with the written answering of such questions as the following:—

Q. How is brass separated into its elementary constituents?

Q. A mixture contains Cu, Pb, Fe, Ba, Ca, Mg; how are the several constituents detected?

Q. What is the action of sulphide of ammonium upon sesquichlorides of iron and chromium and chloride of nickel?

But the examinee has an option of questions, and may omit all the practical, still obtaining the required first or second class; hence there is now hardly any guarantee that future candidates shall have any experience in the laboratory or in the handicraft of their profession.

This practical skill, however, in such subjects as chemistry, mineralogy, botany, physiology, and geology, is essential to their masterly understanding, and is moreover by far the more costly and laborious portion of the science to acquire.

This, if any, is the grievance of the old régime of masters, that they are liable to be confounded with a different class of aspirants; it might, however, be so easily removed by two trifling concessions from the department, that I am tempted to recommend, as they have courted suggestions—

I. Since the present examinations are wholly conducted in the evenings of May, that the mornings of the same days be partly devoted to an additional voluntary examination in the practical portion of such above-named subjects, and that to those candidates only who pass this probation should the masters' printed certificate be issued.

II. That in the register of certificated (which should be retained in some public form), those examined before 1867 should have some distinctive mark attached, *e.g.*, that of their grade.

This arrangement will save both the Government and the master expense; the additional trouble to the four or five examiners concerned will be small.

The department will thus, by equitable and conciliatory measures (considering the pre-eminent character of their noble phalanx of examiners), shortly attain to an influence upon the scientific studies of the country possessed by no other body, whether learned society or university; even in May last they examined 8,439 papers belonging to about 5,000 different individuals.—I am, &c., M. A.

MISCELLANEOUS.

Royal Polytechnic Institution.—A few evenings since, we visited this Institution by invitation from Mr. Pepper. and it gives us considerable pleasure to be able to commend the entertainment. The Polytechnic fulfils now, as it has for many years, a useful purpose, in instructing while amusing its audience. Many who would shrink from reading for instruction, or from attending strictly scientific lectures, would take pleasure in the entertainment given here, and at the same time learn a little of some branch of science. Those who have seen the various optical delusions and have heard the popular lectures on electricity, sound, light, &c., which have from time to time been delivered here, will refrain from quibbling. One of the leading features in the present entertainment is the lecture on the Paris Exhibition, which perhaps deserves the lion's share of praise. Few would imagine how good an idea of the Exhibition may be gained from this lecture; the positions for photographing seem well chosen. The photographs are projected, magnified, on to a screen. Among those which were most noticed were the exhibitions of glass, of the fine arts from Italy, and of English designing, and machine-made jewellery; the photographs, too, of the intricate machinery display came out very clearly. In the reading of "The Bridal of Belmont," by Mr. Millard, a lighter feature in the entertainment is found. This poem offers a fitting subject for a ghost scene, and is taken advantage of; a rather curious musical instrument is also introduced here, which appeared to give great satisfaction. The only other point to which we need allude is the Automatic Leotard, which as a piece of mechanism is very clever.

* An actual exercise proposed in 1865.

NOTES AND QUERIES.

Clarifying Oxymels.—Oxymels can be obtained brilliantly bright without any body being used for their clarification. by keeping the honey at a temperature of 212 deg. Fahr. and separating the scum rising to the surface as long is any is formed, then filtering through twill cloth. The colour of the oxymel however, is much darker than the product obtained by the process of British Pharmacopœia 1867, which merely directs the honey to to be melted.—Scilla Maritima.

Development of Heat.—In my early chemical days I was in the habit of attending lectures at the Polytechnic Institution, London. The lecturer, whenever he was discoursing upon heat, always brought in this story. "There is an old saying, that you may go to the Mint, and carry away as many sovereigns as you please, provided you pick them up with your naked fingers as they fall from the press." The reason you were allowed this privilege, was because they dropped from the die so hot it was impossible to hold them. Can any of your readers say whether the story is a myth, or is it founded upon some former press, as I visited the Mint a few days since, and found that the coin came from the stamp comparatively cold.—Vraisemblance.

Preserving Fresh Flowers.—Flowers may be kept in pretty fair condition, for say a week or ten days, according to the species selected for bouquets and the time of the year, by renewing the water every alternate day, and while doing so rejecting decayed flowers and leaves, and taking care to cut off from the stems immersed in water, with a sharp pair of scissors, about from a quarter to half inch of the length; then should be added to the water about a pinch of salt, and a few grains of saltpetre for every pint of fluid; when flowers are very much faded they may be revived by immersion of the stems for two or three minutes in hot water, or better yet in strong spirits of wine, or Eau de Cologne; in some cases liquid ammonia may be advantageously applied to the stems for a few minutes to revive flowers. These recommendations are applied by several of the largest horticulturists of Ghent and other parts of Belgium, and found to answer in practice very well if properly applied. To keep well flowers should not after being cut be placed in localities where there is tobacco-smoke, or bad ventilation, neither should the rooms be too much heated. —A.

TO CORRESPONDENTS.

Chemicus Junior.—They will be proceeded with.

F. J. Hawker.—The suggestion shall receive attention. We are greatly obliged for the same.

St. Helens.—Chinese blue is a synonym of Prussian blue. See Chemical News, Vol. xv., p. 310.

An Old Subscriber.—They were discontinued mainly because to do bare justice to the subjects would have nearly filled our columns each week. Everything of importance will still be noticed.

Messrs. Cocker, Brothers.—We are unable to give our correspondents the address required. A short note in our advertising columns would doubtless procure it.

W. H. H. Haverford West.—1. Plateau's description for preparing glycerin soap liquid was given in our 4th vol. page 290. 2. Dangerous in a small room. 3. The heat evolved in the combustion of a certain weight of mixed oxy-hydrogen gases is the same whatever the rate of combustion. 4. If our correspondent will favour us with a call we will see if an arrangement can be made.

Communications have been received from F. J. Hawker; Cocker, Brothers; G. Johnson (with enclosure); T. J. Reeves (with enclosure); R. Jamieson (with enclosure); Dr. A. Claus (with enclosure); Rev. C. W. Kett; R. E. Bibby; C. Umney (with enclosure); S. F. Peckham (with enclosure); W. H. Hofman (with enclosure); E. C. Durham; W. Graves (with enclosure); R. M. Brown; W. Andrew (with enclosure); A. B. King (with enclosure); H. Henson; — Remington (with enclosure); F. O. Jackson (with enclosure); B. Simpson; A. Jones; M. Wilson Smythe (with enclosure); W. Bird; Samuel Highley (with enclosure); J. Cliff; C. Nelson; B. W. Gibsone; W. Bywater; J. W. Swindells.

Books Received.—"An Introduction to Pharmaceutical Chemistry," by John Attfield, Ph.D. F.C.S. London: Van Voorst. "The Ophthalmic Review," by J. Zachariah Lawrence. London: Hardwicke. "Squire's Companion to the British Pharmacopœia, 1867." Fifth Edition. London: Churchill. "Practical Hints to the Medical Student," by William Allen Miller, M.D. LL.D.

THE CHEMICAL NEWS.

Vol. XVI., No. 412.

ON THE APPLICATION OF THE

BLOWPIPE TO THE QUANTITATIVE DETERMINATION OR ASSAY OF CERTAIN METALS.

By DAVID FORBES, F.R.S., &c.

(Continued from page 29.)

Silver Assay—

B. Metallic Alloys incapable of direct Cupellation.

b. Containing tin: argentiferous tin, bronze, bell and gun metal, bronze coinage, &c.

Alloys of silver with other metals containing tin do not admit of being cupelled, since the oxide of tin formed by the oxidation of that metal is not absorbed by the bone ash of the cupel along with the litharge, it consequently remains upon the surface of the cupel, and if present in any quantity interferes with the operation. As tin is not volatile when heated on charcoal either in the oxidating or reducing blowpipe flame it cannot be so dissipated, and in consequence, the entire amount of tin contained in any alloy under examination must be removed by oxidation or scorification from the silver lead, previous to its being submitted to cupellation.

For this purpose: 1 part of the stanniferous alloy is fluxed with from 5 to 15 parts granulated assay lead (according to the amount of copper suspected to be present in the alloy), 0·5 part anhydrous carbonate of soda, and 0·5 part pulverized borax glass, made up as usual in a soda paper cornet, and the whole at first gently heated in reduction flame, until the soda paper is charred and the alloy has afterwards united with the lead to form a single globule, whilst the borax and soda have combined as a glass or slag in which the soda prevents the easily oxidisable tin becoming oxidised to any extent before a perfect alloy has been formed with the lead, which then contains the whole of the silver.

As soon as this is effected, the blowpipe flame is altered to an oxidating one, and the metallic globule is kept at the point of the blue flame, which should touch it so as to cause the tin to become oxidised and be at once taken up by the glass surrounding it.

Should, however, it be seen that minute globules of metallic tin made their appearance on the outer edge of the slag or glass,* the operation must be at once discontinued, and the assay allowed to cool; after cooling the metallic globule is detached from the slag surrounding it, and being placed in a cavity on charcoal, is fused in the reducing flame along with a small piece of borax glass and afterwards treated with the oxidating flame exactly as before (and if necessary, which is seldom the case, unless when treating argentiferous block tin, this operation may again require to be repeated), until it is seen that the surface of the metallic silver lead globule does not any longer become covered with a crust or scales of oxide of tin, but presents a pure and bright metallic surface.

The silver lead globule is now quite free from tin, and can be cupelled and the amount of silver determined as usual.

c. Metallic alloys containing much antimony, tellurium, or zinc: antimonial silver and argentiferous antimony, telluric silver and argentiferous zinc.

Alloys of antimony with silver when treated on charcoal in the oxidating flame give off all their antimony, leaving the silver behind as a metallic globule having a frosted external appearance; telluric silver, on the contrary however, when treated in similar manner only evolves a part of its tellurium, and even after cupellation with lead a small amount of tellurium generally remains behind alloyed with the silver.

All these compounds may be assayed as follows:—

One part of the alloy is placed in a soda paper cornet along with 5 parts granulated assay lead, and 0·5 part pulverised borax glass, and fused in reducing flame until the globule and slag are well developed; the oxidating flame is now directed on to the globule, causing the whole of the zinc along with most of the antimony and part of the tellurium to volatilise before the lead commences oxidising. The last traces of antimony are removed with some difficulty, during which operation some portion of the lead becomes oxidised. On cooling, the globule is now separated from the slag and concentrated upon a coarse bone ash cupel as usual, and if no tellurium were present in the concentrated silver lead, this may now be cupelled as usual.

If tellurium is present, as is seen by the concentrated globule of silver lead possessing a dark coloured exterior, it must be remelted with 5 parts assay lead and again concentrated, and these operations, if necessary, must be repeated until the surface of the concentrated globule is found to be clean and bright as usual with pure silver lead, when it may be cupelled fine and the silver globule weighed.

It sometimes happens, even after all these precautions have been taken, that the silver globule after cupellation shows a crystalline, greyish white, frosted appearance from its still containing tellurium; in such cases its own weight of assay lead (in one piece) should be placed beside it on the cupel, melted together, and the globule again cupelled fine on another part of the surface of the same cupel. In assaying substances very rich in tellurium the results obtained are, however, not very satisfactory, and may be as much as one or two per cent too low, even after employing all precautions.

d. Compounds of silver with mercury; arquerite, native and artificial amalgams and argentiferous mercury.

The assay of these compounds is very simple. A weighed quantity of the liquid or solid amalgam is placed in a small bulb tube, and heated over the lamp very gradually in order to avoid spirting and to allow the mercury to volatilise quietly†; the heat is increased by degrees as long as any mercury is driven off, and the residue is heated for some time at a red heat in order to drive off as much mercury as possible without fusing the glass or causing the residual silver to adhere to it. The mercury expelled condenses itself above the bulb on to the upper part of the tube, and by gently tapping will collect in globules, which by carefully turning the tube unite and can be poured out of the tube; after which the silver, left behind as a porous mass, may be removed from the tube, and after being fluxed with an equal weight of granulated assay lead and half its weight of borax glass, must be fused on charcoal in the reducing flame, and the button on cooling cupelled as usual. Should, however, much copper have been present in the amalgam, a proportionately larger amount of assay lead is required to be added.

When the argentiferous residue is extremely small, as is often the case when assaying argentiferous mercury, this may adhere firmly to the glass of the tube. On such occasions this part of the tube must be cut off with the adherent residue, and the whole fused in a strong reducing flame along with its own weight of granu-

* This occurs when the flux has become so saturated with oxide of tin that it cannot take up any more.

† In the case of solid amalgams, which often spirt very violently, this may be obviated by wrapping the assay in a small piece of tissue paper, and heating it in a blow-pipe crucible, when all the mercury is given off quietly, leaving the silver behind;—a useful little dodge shown the author lately by Mr. Crookes.

lated assay lead, and with half its weight of anhydrous carbonate of soda. Upon cooling, the globule of silver lead thus obtained is cupelled as usual.

(*c*.) Compounds chiefly consisting of iron; argentiferous-steel; cast-iron; bears from smelting furnace.

Compounds consisting principally of iron with a small percentage of silver, although occasionally produced in the arts intentionally, as,for example, the so-called silver steel, are commonly found on the blowing out of furnaces used in the smelting of silver and copper ores, and are frequently rich in silver, as is the case with the bears from the silver furnaces at Kongsberg in Norway. An alloy of iron with silver is occasionally also found appearing in small quantities on the surface of melted silver in the process of casting, and in some cases at least this may be due to the action of the melted silver on the iron rods used for stirring up the molten metal.

As iron cannot be made to alloy itself with lead before the blow-pipe, it becomes necessary to extract the silver by a more indirect process than is used in the case of other alloys containing that metal. In order to remove the iron the alloy must first be converted into sulphide of iron and silver, and to effect this, the iron or steel must be reduced to powder, or fragments none greater than about a quarter of a grain in weight; for which purpose steel when hardened may require to be softened previously.

One part of the finely-divided iron or steel is now mixed with 0·75 part sulphur, eight parts granulated assay lead, and one part pulverised borax-glass; the mixture after being placed in a soda paper cornet is carefully fused in a cavity on charcoal in the reducing flame, until the whole appears as a fluid globule containing both the lead and iron in combination with the sulphur. Without removing either this globule or the glass surrounding it from the charcoal, an amount of borax glass in one or more fragments (in all about equal in weight to the original amount of iron employed), is now added (in order to combine with and slag off the whole of the iron), and fused along with the former globule, after which the whole is submitted to a strong oxidating flame until the impure lead globule shows itself protruding from the slag.

The charcoal is then inclined so that the lead is alone subjected to the action of the outer flame, in order to volatilise the sulphur, aud at same time oxidise the iron which goes into the slag; this operation is continued until the globule of lead appears with a bright metallic surface; should it on cooling, however, be found to possess a black colour, and to be brittle, it must be still further oxidised as before described.

The silver lead thus obtained will now be found to contain all the silver, and at the same time to be free from both iron and sulphur, and can be cupelled as usual.

No notice is here taken of alloys of silver and gold, since these metals cannot be separated before the blow-pipe by any process yet known; and in all cases where gold may be present in an alloy, treated as here directed for obtaining its contents in silver, the gold also will be found to follow along with the silver, and must be parted from that metal by the humid method, in order to enable the true amount of silver present in the substance to be ascertained.

The British Association.—A meeting of the Local Invitation Committee of Exeter and Plymouth for securing the visit of the British Association to one of these places in 1869, has been held to consider what steps should be taken to end the present rivalry. After much discussion, it was decided to refer the question to the last three Presidents of the British Association, Professor Phillips, Mr. Grove, and the Duke of Buccleuch, to say which town should retire and help the other.

ON ULTRAMARINE.

By DR. ERNST RÖHRIG.

(Concluded from page 189.)

Several other formulæ for producing ultramarine have been published. Only those already referred to have been mentioned, as the investigators have at the same time started some theory explaining the blue colouration.

Having been engaged in ultramarine manufacture for a number of years, I may also state that all the published modes of producing ultramarine are incapable of application to the manufacture on a large and lucrative scale, though they are all very well for analytical researches in the laboratory. I may be allowed to state here also, that the mixture for manufacturing ultramarine is not the only secret connected with it; there are many others besides, which manufacturers mostly obtain by many very expensive experiments.

The supposed colouring principle in ultramarine has been variously stated by different investigators.

Before the composition of lapis lazuli was known, it was believed that copper was the cause of the blue colour.

Marggraf* first confuted that opinion, and he attributed the blue colour to iron. Klaproth† was of the same opinion.

Guyton Morveau‡ also attributed the colouring matter to iron. He had observed that sulphate of lime containing iron became blue when heated with carbon, and that the blue colour disappeared again when it was acted upon with acids.

Varrentrap§ inferred from the analysis of nosean, sapphirine, lapis lazuli, and artificial ultramarine, that the intensity of the blue colour increased with the amount of sulphur and iron, and he considered it possible that the blue colour was attributable to sulphide of iron.

This analysis of artificial ultramarine gives the following numbers:—

Silica	45·604
Alumina	23·304
Soda	21·476
Potash	1·752
Lime	0·021
Sulphur	1·685
Sulphuric Acid	2·830
Peroxide of Iron	1·063
Chlorine	trace
	98·735

Prückner‖ stated that he could not produce ultramarine from clay which was free from iron; he, therefore, recommended an addition of green copperas, and was of opinion that iron was essential for the blue colouring.

Elsner¶ arrived, by a number of experiments, at the conclusion that the colouring principle was a combination of sulphide of iron and sulphide of sodium. He found that Gmelin's ultramarine base free from iron heated with sulphur and soda, also free from iron, produced a yellowish-white mass, whilst when using materials containing iron, a green mass was obtained.

Now, the supposition of iron being the blue colouring matter has a very weak foundation, since, on the contrary, it is proved by Gmelin, Desormes, Clement, Bounner, and Ritter, that ultramarine may be produced from materials free from iron.

Iron, and likewise lime, magnesia, &c., substances which are often to be met with in ultramarine, are only accidental components, and have no relation whatever to its blue or green colour.

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* *Marggraf's Chem. Schriften, Berlin*, 1768.

† *Klaproth's Beitrage z. Chem. Kenntn, der Mineralien i.* 189.

‡ *Poggend. Annalen* xlix. 521, 550.

§ *Ann. de Chimie*, xxxiv. 54.

‖ *Journal f. Pract. Chemie*, 1844, *bd.* 3.

¶ *Journal f. Pract. Chemie*, xxiv. 285, xxvi. 106.

Desormes and Clement were the first who found, by analysing the natural mineral, that it contained no iron. This metal, therefore, could not be the colouring principle; but they expressed no further opinion on the subject.

Gmelin considered the sulphur as the cause of the blue colour. He thought he had observed that in decomposing ultramarine by hydrochloric acid, sulphuretted hydrogen gas and sulphuric acid were formed, and he concluded from this that either a metallic sulphide, together with a sulphate, were contained in ultramarine or hyposulphurous acid, which was decomposed into sulphuric acid and sulphuretted hydrogen, a decomposition of water taking place at the same time.

Gmelin seems to have given the preference to the latter supposition, which is yet clearly erroneous, as hyposulphurous acid, when separated from dilute solutions of its salts by means of an acid, becomes decomposed into equal equivalents of sulphurous acid and sulphur.

Schweigger Seidel* states that the colouring matter of ultramarine is Vogel's blue sulphuric acid (solution of sulphur in anhydrous sulphuric acid); but he does not prove how sulphuretted hydrogen gas could possibly be evolved from that acid; and, besides, there is no sulphuric acid contained in ultramarine.

Elsner called attention to the important fact that by decomposing ultramarine by means of acids, sulphuretted hydrogen gas was evolved, and that, at the same time, sulphur became separated. He found the proportion of the evolved sulphuretted hydrogen gas to that of sulphur to be—

In green ultramarine at .. .. .. 3·6 : 1 and
,, blue do. ,, ... 1 : 7

and he supposed that the blue ultramarine contained a higher degree of sulphuration of sodium than the green ultramarine.

Breunlin† was of the same opinion. A great number of analyses of the blue and green ultramarine induced him to consider that both kinds of ultramarine consisted of a combination of a nephelin-like silicate and sulphide of sodium, the latter in blue ultramarine having the formula NaS_5, and in green ultramarine, NaS_2.

He made the following formula to represent the composition of the ultramarine:—

$$2\Big([(2NaO)SiO_3]+2[Al_2O_3,\ SiO_3]\Big)+NaS_5$$

and for green ultramarine—

$$2\Big([(2NaO)SiO_3]+2[Al_2O_3,\ SiO_3]\Big)+NaS_2$$

Gentel‡ found also by analysing different yellowish-green sorts of ultramarine, a proportion of evolved sulphuretted hydrogen gas and separated sulphur corresponding to NaS_2, but he is of opinion that the green ultramarine has a very different composition, and he assumes that it contained a mixture of different combinations of sulphur with sodium. He found in one sample of blue ultramarine a proportion corresponding to NaS_{10}, and he thinks it not improbable that ultramarine consists of a silicate of alumina, and a combination of silicate with sulphide of sodium. But he considers the proportions not sufficiently ascertained to justify forming a formula.

Wilkens§ concluded from this mode of producing ultramarine that the blue colouring principle was hyposulphurous acid in combination with soda and NaS.

Stolzel‖ considered sulphite or hyposulphite of soda to be the cause of the blue colouration.

Brunner¶ supposed that blue ultramarine contained oxidised sulphur; but he made this supposition from an erroneous observation (influence of burning sulphur upon green ultramarine).

Ritter has drawn from his investigations on the subject the following conclusions:—

1. The combination formed by heating NaS together with silicate of alumina is colourless, and consists of silicate of alumina and soda and NaS, and a higher sulphide of sodium; this compound contains no combination of oxygen with sulphur.

2. By extracting some sodium from the white ultramarine (by the action of Cl or SO_2) a corresponding quantity of S will combine with the remaining NaS, and form a higher sulphuret of sodium.

3. The white ultramarine converted in such way absorbs oxygen (one part of the NaS being transformed into an oxygen compound), and takes the blue colour. The blue ultramarine, therefore, forms a combination of a silicate of alumina and soda, polysulphide of sodium, and sodium salts with one of the oxides of sulphur.

4. It is probable that the combination of O with S contained in blue ultramarine is either as sulphite or hyposulphite of soda; the latter is the more likely.

5. KS, when heated with silicate of alumina, does not form an ultramarine-like combination; the result is a silicate of alumina and potash free from sulphur.

We know that sulphur may take a blue colour in three cases:—

1. When sulphur is in combination with anhydrous sulphuric acid;

2. By melting Rhodanide of potassium at a temperature approaching a red heat;

3. The sulphur which gets separated in mixing sulphuretted hydrogen with chloride of iron.

Considering these facts, it may be possible that a blue modification of sulphur may exist in ultramarine.

* *Schweigger's Journ.* liv. 280.
† *Ann. de Chemie u. Pharm.*, xcvii. 295.
‡ *Dingl. polyt. Journ.*, cxli. 116.
§ *Ann. de Chem. und Pharm.*, xcix. 28.
‖ *Ann. de Chem. und Pharm.* xcvii 35.
¶ *Poggend. Annalen*, lxvii. 541.

ON THE

CONSTITUTION AND PROPERTIES

OF THE

HÆMATITE IRONS OF WEST CUMBERLAND

By EDMUND G. TOSH, Ph.D.

(Concluded from page 203.)

As I mentioned in the earlier part of my paper, the quantities of sulphur and phosphorus, particularly the latter, in iron, are not very materially lessened by its conversion into steel by the Bessemer process, hence only those varieties of crude iron can be used which contain an exceedingly small proportion of these elements, otherwise the resulting steel would be of very inferior quality and possess the properties of cold and red-shortness in an objectionable degree. This is a drawback to the very general application of the Bessemer process, as only in exceptional cases are irons of sufficient purity to be met with. Numerous attempts have been made to remove these substances, and many patents have been taken out with the same object, but as yet none have been successful. Calvert recommended the use of common salt, but its volatility at the extraordinarily high temperature of the metal while undergoing decarburization was an impediment to its employment. Recently a patent has been taken out by Wintzer, a Hanoverian ironmaster, for the use of chloride of calcium for the removal of these objectionable substances. If chloride of calcium have the effect desired, a great obstacle will have been overcome, but I have not heard of any experiments having been made with it.

I have estimated sulphur, phosphorus, and silicium in a specimen of steel made from Harrington pig iron (II. in the table). The percentage amounts in the iron and steel respectively are as follows:—

	Iron	Steel
Sulphur	0·075	0·034
Phosphorus	0·055	0·046
Silicium	2·286	0·172

Red-shortness.—I have already observed that malleable bars made from hæmatite pig iron by the ordinary process of puddling, are so exceedingly red-short as to be almost useless. A piece of this iron at a dull red-heat is so brittle that it breaks into fragments after a few blows under the hammer. This most remarkable and undesirable property can not in the present instance be ascribed, as it usually is, to the presence of an excessive quantity of sulphur, for even the raw hæmatite iron contains a less proportion of that element than the refined malleable bars of the best Swedish and English makes, such as Dannemora and Lowmoor; and it is very unlikely that the amount of sulphur should increase by puddling.

The Cumberland pig irons are as a class rich in silicium, and on the other hand contain very little manganese, and I am inclined to think that these co-existing peculiarities of constitution point towards the true cause of red-shortness in the present case. Caron * made the very interesting observation that at a high temperature in an oxidising atmosphere, manganese possessed the power of removing silicium from iron. This property at once assigns to manganese a place of high importance in connection with many operations in the metallurgy of iron, particularly that of puddling. Until spiegeleisen began to be used in making Bessemer steel, and its beneficial influence forced itself to be recognised, the action of manganese was greatly ignored by many practical men, at least in Britain. Any literature we have on this neglected subject is, for the most part, of an exceedingly vague description: the determination of manganese in iron by commercial analysts is often looked upon as a matter of minor importance, hence we have no good grounds to go upon in seeking to understand the action of this substance. It is, however, highly probable that in the removal of silicium by puddling, manganese plays a very important part, and looking upon the small proportion of this metal in hæmatite pig iron, in forcible contrast with the large amount of silicium, it is very possible that a comparatively large percentage of the latter element remains combined with the iron, exerting upon it a most deleterious effect, and causing the red-shortness in question. Unfortunately I have not a specimen of the malleable iron at my disposal, otherwise I might test, by chemical analysis, the value of these remarks.

Titanium.—This substance exists in small quantities in all the hæmatite irons I have examined, very probably combined with cyanogen and nitrogen, forming cyano-nitride of titanium, the composition of which was first shown by the classical researches of Wöhler. † Although the effect of its presence in iron is not distinctly known, the prevailing opinion among chemists and metallurgists is, that the cyanogen compound being probably merely diffused through the metal, and not chemically combined with it, its influence is very small. In repairing the blast furnaces in the Cumberland district, very considerable quantities of this cyano-nitride of titanium are found in the vicinity of the hearths, generally in the irregularly shaped lumps which though black and dull on the outside, exhibit when broken an exceedingly beautiful copper-coloured mass of crystals, among which a little iron is diffused. All crystals I have seen were octahedral, and although I have tried several times to obtain a perfect octahedron by dissolving away the surrounding iron with dilute hydrochloric acid, I have not succeeded. The faces of the crystals are rough and deeply striated, resembling occasionally the skeleton forms presented by common salt.

I examined the blast furnace slag for titanic acid, and found that it contained a mere trace.

Nitrogen, as it occurs in iron, stands in close relation with titanium. According to Caron † it is to be found to a greater or less extent in all commercial iron, from which it can only with the greatest difficulty be perfectly removed. The proportions of the titanium and nitrogen in these hæmatite irons, as determined by me, are not by any means those which are found in cyano-nitride of titanium, but where quantities are so small the unavoidable errors of analysis may account for any such difference.

Although somewhat out of place, I would here make some remarks upon a specimen of slag from one of the Cumberland blast furnaces, which when analysed was shown to have the following composition:—

		Oxygen.
Silica	30·200	16·11
Alumina	12·007	
Protoxide of Iron	1·269	
Lime	50·507	21·58
Magnesia	2·553	
Alkalies	1·225	
Sulphide of calcium	2·400	
Phosphoric acid	trace	
Titanic ,,	trace	
Protoxide of manganese	trace	
	100·173	

The percentage of silica is strikingly low, and if it be calculated it is found that the bases are very considerably in excess, the relation of oxygen being about 8 in silica to 10 in the bases.

I have often heard of the loss some of the companies in this district experience from the rapid wearing out of the furnace lining; sometimes after only three months working, or even less, the fire bricks were quite burned through. If the specimen analysed represents the slags usually produced, and is not a very exceptional case; this destruction of the furnace lining is easily explained. If unneutralised bases cannot find silicic acid in the ores to combine with, they will seek it elsewhere, and coming in contact with the firebrick lining will at once attack the silica in it, causing this disastrously rapid wear and tear of which I have heard so many complaints. In order to remedy this evil, furnace managers must either use less limestone or a larger quantity of siliceous matter.

This slag was of very vesicular and open structure, and of a greyish colour, agreeing closely with another described by Percy §, which he looked upon as a highly basic silicate, a conjecture fully confirmed by my analysis.

The Bessemer process, as yet in its infancy, presents a most interesting subject for study and examination. The chemical reactions involved in the process are still imperfectly understood, and a careful series of observations of the phenomena which are presented during its performance, while leading to a correct knowledge of the changes which take place during the conversion, would I have no doubt give us much more correct and reliable views as to the internal constitution of raw iron than any which we hitherto possess.

Solubility of Anhydrous Alumina in Ammonia.—If alumina is heated to whiteness, and pounded up fine, then allowed to remain in contact with ammonia for a few hours, a tolerably heavy gelatinous precipitate is produced by chloride of sodium, or ammonium.—*William Skey, New Zealand.*

* "Memoire sur les Aciers.

† *Ann. d Chem. u. Pharm.* lxxiii. p. 33.

† Memoire sur les Aciers.

§ "Metall. Iron and Steel," p. 506.

ON A NEW TEST FOR HYPOSULPHITES.

By M. CAREY LEA.

In an examination of the platinum metals which I published some time back in this journal, I described a very delicate test for ruthenium, by which the faintest traces of that metal could be detected through the agency of hyposulphite of soda. Recently, having occasion to test for the last-named substance, it occurred to me as probable that ruthenium might be rendered available for that purpose. This I found to be the case, and that the reaction exhibited considerable delicacy. It is true that ruthenium is at present a very rare metal, and not within the reach of all who might wish to use it, but the changes from rarity to more or less abundance are now so common and sudden that present scarcity is no reason for ignoring any useful reagent.

When a solution of ruthenium is rendered alkaline by ammonia and boiled with hyposulphite of soda, it gradually assumes a rose colour which passes into a rich carmine; with strong solution the colour is so intense as to be almost black. When diluted the shade is magnificent, rivalling the aniline red in richness.

I have already stated within what limits ruthenium can be detected by hyposulphite of soda. I now subjoin the limits observed with respect to hyposulphite of soda.

A solution containing one four-thousandth of hyposulphite, gave a clear rose red.

One containing one twelve-thousandth gave a well marked pink liquid.

One containing one twenty-five-thousandth gave a salmon colour.

The experiment was not carried further because the salmon colour in the last-mentioned trial showed that the test had then reached its practical limit. I do not doubt that even with one hundred thousandth a colouration could be obtained, but it would not have the specific distinctness given by the carmine and rose shade previously described.

A few words remain to be said as to the best mode of applying this test.

I have recognised in solutions of sesquioxide of ruthenium a strong tendency to decompose by dilution; dilute solutions have a strong tendency to gradually deposit their ruthenium as oxide. And even before the slightest sign of a precipitate appears, in fact immediately upon dilution, solutions show a tendency to change their reactions. So that I find it invariably better on diluting the ruthenium solution for use in testing, to boil it (as I have elsewhere pointed out in speaking of the dilution of ruthenium) with a few drops of hydrochloric acid, and this even although the solution is to be immediately afterward rendered alkaline by ammonia. To ascertain with certainty that this improved the delicacy of the reaction, I made comparative experiments on two portions of the same ruthenium solution, and found that the colouration by hyposulphite was at least three times stronger in the case of the portion that had been boiled with HCl than with that that had not.

As ammonia was thereafter immediately added, it might appear that the function of the hydrochloric acid was to form hydrochlorate of ammonia. But it was found by experiment that the addition of sal-ammoniac in no way aided the reaction.

The addition of ammonia to a hot solution of sesquichloride of ruthenium immediately darkens it to a blackish olive colour, which, according to the dilution and the light that falls on it, is of a reddish or a greenish shade. By standing, the ruthenium is precipitated as oxide. As this condition is the necessary preliminary (as before explained) to the production of the characteristic carmine reaction, it is not a little singular that the delicacy of that reaction should be so greatly enhanced by taking steps to strengthen the combination with excess of acid and boiling, immediately before the affinities are to be loosened by ammonia.

In using this reaction for the detection of small quantities of hyposulphite, it is useful to remark that it succeeds best when very little ruthenium is present. After the ruthenium solution has been boiled with acid and supersaturated with ammonia, and the liquid to be tested for hyposulphite added, the mixed solution should have so little ruthenium in it as to exhibit only a very pale transparent olive colouration—should in fact be almost without colour. Otherwise if the hyposulphite is present in mere traces, we get a salmon or flame colour instead of the pure carmine.—*American Journal of Science*, September, 1867.

PRACTICAL HINTS TO THE STUDENT.*

By WILLIAM ALLEN MILLER, M.D., LL.D., V.P.R.S.

Professor of Chemistry in King's College.

I shall best consult the wishes of those whom I represent, and shall be doing what is most fitting upon such an occasion, if I aim at usefulness rather than novelty; and for that purpose I shall direct my remarks chiefly to those who are just commencing their career among us, and who may perhaps not unnaturally feel some degree of perplexity and apprehension at the formidable array of studies to which they are now at once introduced as a preliminary to the practice of their profession.

It will not be sufficient for any one of you, however diligent, to content himself with mere attendance upon lectures. Admirable as these may be, they can only present an outline of the subject, which the student must fill up by reading and reflection. No man can really do the work of thinking for another, if that other is to be anything more than a cypher. The most important part of every man's education is that which he gives to himself. He must learn to master his own mind, and to conquer the tendency which everyone naturally has to prefer ease to persevering work. When once the habit of steady application has been acquired, all others are comparatively easy.

In preparing yourselves for the practice of your profession, your great object must be to seize upon the principles of each branch of your studies; and it is here that good lectures are of such value in directing the mind of the student. Do not suppose, however, that I wish you to undervalue the acquisition of even very minute details in certain cases. Details indeed are not to be despised or neglected, for it is upon the mastery of detail that all successful practice depends. All acquired knowledge, to be valuable, must be precise as far as it goes; but the selection of those points that must be filled up minutely, and the omission of details where the knowledge of the principle only will suffice in others, are essential conditions to success in study; and in such cases a hint obtained from the Professor may often save you many an hour of profitless labour. For example—The custom of taking notes during lectures is one which may be beneficial or injurious, according to the mode in which it is carried out. If judiciously managed, it may be of great value. Unless, however, you are a master of shorthand it would be a mistake to endeavour to take down all that is said. The great value of notes of lectures will be to guide you in your subsequent reading; but since most of the details given in systematic courses of lectures will be found in the text-books upon the subject, it would be waste of effort to do more than preserve the heads and main divisions of the discourse. If more be attempted, the attention is in danger of being distracted by the mechanical effort of writing, and the drift of the argument of being lost in consequence. It will often be useful to take down

* Extracts from an Introductory Lecture at the opening of the Medical Session at King's College, London, October 1, 1867.

references to books, numerical details, and special information of any kind. If it is an experimental lecture, a list of the illustrations employed may be preserved; whilst a sketch of any particular piece of apparatus, or of the arrangement of an experiment, will frequently both save a long description and recall the whole more vividly to the memory. In short, good notes to a lecture are like an index-map to an intricate country, upon which a few of the leading rivers, mountains, and cities are clearly marked out.

Every student who aspires to distinguish himself—and who is there among you that does not?—must set apart methodically certain portions of the day for study. Four or five hours a day spent in real study, in addition to the time occupied in the class-room, in dissecting, and at the hospital, will be as much as will be profitable to most men. The mental food, like the food for the body, must be digested and assimilated, otherwise it will not become part of the mind, nor will it be available for use.

This systematic and orderly arrangement of your studies will be greatly facilitated by the custom of drawing up every evening a plan for your work on the following day; it will preserve you from indecision, and will save time as you pass from one pursuit to another in its due order. You will then also be in less danger of falling into the habit of procrastination, which so often ruins a promising character. If you know that a thing which must be done can be done at once, do not postpone it. The recollection of the duty will either hang uneasily over you, and rob you of your repose, or else you will become indifferent; the habit of delay will be confirmed, and your power over yourself will be weakened.

The first requisite to successful study is the concentration of the powers of the mind upon the subject in hand; and this concentration of the faculties, though a voluntary act, is difficult at first to accomplish, but it gradually becomes easier by repeated practice. A well-trained mind will find that this process will afford invaluable aid to the memory, even when not naturally retentive, whilst it will enable one endowed with a really strong memory to acquire a knowledge, at once ready and accurate, of any subject which he may select.

We often hear complaints of memory on the part of those who really ought to blame themselves for want of attention. The same man who complains that his memory is so bad that he forgets what he has read as soon as he has closed the book, will, nevertheless, often give you the particulars of a boat-race, or of a game at cricket, or of football, in which he was himself personally interested, with the minute details of every incident, showing no want of memory in this case, where his bodily and mental powers were called into full activity.

The mind must be directed to the subject for a certain time with a view to remembering it, and the idea must be strengthened by repetition. Systematic repetition or review of the leading features of the subject under study should never be neglected. It is irksome, but indispensable. This habit of directing the mind intensely to whatever comes before it in reading or observation should therefore be cultivated by all means in your power, and the opposite habit of listless inactivity should be carefully guarded against, for in this lies the foundation of a sound intellectual character.

Next to attention, there is nothing that affords so important an aid to the memory as the habit of associating ideas correctly with each other. The constant practice of tracing the relation between new facts and those already acquired; the custom of referring facts to the principles which they confirm, illustrate, or extend, is of the utmost value; since it not only fixes the new facts firmly in the memory, but it refers them to their proper place in the mind, thereby enabling you to recall them in connection with the subject itself to which they relate. This mental operation is most important to prevent confusion of mind. Indeed, it is not less necessary than the corresponding mechanical process of arranging one's papers; in which every one at once feels the importance of separating those relating to different subjects, while those referred to allied ones are placed together, each series being indicated by its appropriate label.

The habit of correct association may be attained by any one, but it requires assiduous cultivation. It not only exerts a great influence upon the acquisition of knowledge, but also upon the formation of the mental characteristics; and it is closely connected both with that activity of mind which it is so important to foster, and with that soundness of judgment upon which so much of the solidity of a character, and its usefulness to others, must depend in future life.

In many sciences our knowledge rests upon an assured and exact basis. This certainty depends upon the facility with which we can trace effects to their true causes, can predict the effects of known causes, and consequently can calculate upon the absolute uniformity with which particular results may be obtained. This is a certainty which can be secured so long as we are dealing with limited portions of inanimate matter. We can determine with absolute accuracy the effects of a mechanical combination, and we can predict the results of a chemical experiment which we have already tried. If the consequence which we expect does not follow, we are sure that some unobserved disturbing agent has prevented the conclusion which we anticipated; and a little observation will enable us to discover and obviate its effects. It is our accurate knowledge which gives us the power that in so many instances we possess over material objects; and we must remember with Bacon, "Natura non nisi parendo vincitur."

The knowledge of the philosopher differs from that of the uneducated man less in kind than in degree, and in the manner in which it is acquired. In addition to the observation of the phenomena as they occur, the man of science institutes *experiments*; that is to say, he arranges and selects certain circumstances and excludes others, so as to enable him to determine what are the necessary, and what the merely accidental antecedents of the phenomena which he is examining; and upon the skill with which those experiments are arranged depends his progress in the discovery of scientific truth.

Now, in medical science there are sources of uncertainty which do not exist in physical science. One of the most important of these arises from the fact that, in most cases, we cannot make experiments and vary them at pleasure. In nearly every case of disease we must content ourselves with the observation of the phenomena: and how much lies hid even from the most careful observation! We see complex results only, but cannot trace all the conditions necessary to produce them. Hence accurate inferences can be deduced only by slow degrees; and hence it is in so many instances difficult to estimate the true value of the conclusions at which we have actually arrived.

* * * * * * * * *

The remaining subject with which you will be engaged during your first winter session is *Chemistry*; by which you are taught the nature, properties, and modes of combination of the different kinds of matter; a science of vast extent, and of fundamental importance to you. From its wide range, and its difficulty, there is no branch which the student is more often tempted to neglect than this, although its bearing upon the practical part of his profession is unquestionably very great. It will be my business, after impressing upon you its leading principles, to endeavour to guide you in selecting those parts of the science which admit of direct application to your profession. For instance, the microscopic investigations of the physiologist and the pathologist would be partial and incomplete if the various tissues were unravelled only by the aid of the scalpel or the needle. The judicious use of solvents, the application of tinctorial agents, and the

various expedients of microscopic chemistry, must be called in at every step to assist the ruder dissections effected by the knife.

With the chemistry of the atmosphere and of water many of the most important problems of hygiene and sanitary science are bound up. Efficient ventilation, or the removal of that portion of the atmosphere which has become chemically altered by respiration or by combustion, and which is consequently no longer fitted for the due support of life, is one of the great objects of the sanitary reformer. It is for this purpose that he widens streets, opens courts, puts in additional windows, and inserts ventilating gratings. It is to prevent the pollution of the air we breathe by the miasmata evolved by decaying animal and vegetable matter, and the spread of pestilence and death, that it becomes necessary to close the cesspool, and to cause the closet to be properly trapped. It is for this reason that the officer of health insists upon the removal of heaps of ordure, which, when duly returned to the soil, serve as needful manure to stimulate the growth of future plants, and which, by the transforming actions of the chemistry of vegetation, again become fitted to supply food and vigour to the animal creation.

Typhus, diarrhœa, even cholera itself, may often be traced to contamination of the water supply of a district with organic impurity; and in such cases a simple chemical examination of the water has often revealed the acting cause, and thus led at once to the adoption of the appropriate remedy in the introduction of water from a purer source. As illustrations of the direct applications of chemistry to medical practice, I need but remind you of the large and important class of diseases of the kidney and bladder. The different forms of gravel and the varieties of calculous affections can only be successfully treated by carefully watching the changing chemical conditions of the urine and its deposits. In diabetes and albuminaria. it is from the application of chemical tests that the physician obtains the most rapid and certain indications of the progress of the disease and the effects of his remedies.

Few subjects offer more important matter for investigation from a chemical point of view than the various forms of dyspepsia; for there is no function more intimately dependent than digestion upon chemical changes; and yet there are few over which we at present possess less definite control. The manner in which the food becomes converted into a soluble form, suitable not merely for absorption but for assimilation, is, indeed, but little understood; and no greater service could be rendered to practical medicine than a sound interpretation of the physiology of digestion, and of the pathology of dyspepsia; and this we must look for at the hands of the chemical physiologist.

Let me, then, earnestly urge you to the diligent study of the principles of chemistry. In no branch of science is it of more importance to obtain a strong grasp of principles, and in none, from the enormous mass of facts which it embraces, is a judicious selection of the parts to be studied in detail more indispensable. At the same time there is no subject which will by its intrinsic value and interest more amply repay the time and labour bestowed upon its acquisition.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, Oct. 24, 1867.

Preparation of Hydrogen on the large scale—Chemical Manures—The Chemistry of Rotten Eggs—Still another Cure for Cholera.

For the very costly process of the preparation of hydrogen by iron and sulphuric acid, M. Giffard now substitutes the decomposition of steam by incandescent coke. The gas is produced in a sort of furnace charged at the back with coke, divided by refractory stones at the front into a great number of channels which are traversed by the gas. When the fire is well lighted, the sides of these channels attain a red heat, and the coke is uniformly red throughout its thickness, which is considerable. Then the damper is shut, the ashpit closed, and a jet of steam is made to play on the under surface of the coke. By traversing this mass of coke, the steam is decomposed, producing carbonic oxide, and hydrogen gases.

At the upper part of the boiler there are nine small jets of steam which pass through the carbon and mix with the hydrogen and oxide of carbon as far as the red hot channels, where a new reaction takes place. The carbonic oxide gas is more highly oxygenated at the expense of the steam and is converted into carbonic acid gas, while the hydrogen is set at liberty. The system of tubes is very ingeniously contrived; the tube which unites the two boilers and supplies the four cylinders, is prolonged on the opposite side in case of need. Two tubes, which start from the principle trunk conduct the jets of steam which pass over the coke, and those which traverse it for the production of gas. Two other tubes called blowers, leading to the chimney and the ashpit, assist the combustion by jets of steam. The second produces a reversed draught in order to produce a downward combustion. Lastly, two groups of tubes furnished with and controlled four ways by cocks conduct the steam to two cylinders, the object of which is to open and shut, one the ash-pit door, and the other the damper of the chimney. The gas on quitting the generating furnace is necessarily charged with much steam, and it passes into tubes kept constantly surrounded by cold water, changing continuously, which condenses the greater part of the steam; the water of condensation falls into the bottom of a sort of vertical tubular boiler, transformed into a refrigerator, and is let out by a discharge cock. The gas then passes through a lime purifier, in which it is desiccated before it arrives at the balloon. The purifier is a large case of strong boiler plate, with a man hole at top for introducing the lime, and a grating at the bottom on which the lime rests, and beneath which the gas passes. At a small distance above the grating there are moveable plates revolving on their axes. In the ordinary position in which they are placed, vertically on their edges, the gas enters by interstices similar to those of a Venetian blind. But when the lower part of the lime is exhausted the plates are turned horizontally; they then form a floor on which the unslacked lime rests.

The production of gas is intermittent. When the steam has in part extinguished the coke and cooled the sides of the refractory stone, the admission of the steam is cut off; the ash-pit and damper closed, then one or other of the blowers are set in motion, and the operation of gas-making commences.

M. Georges Ville, the learned professor of the Museum, has rendered to the agricultural world an immense service. In fact, plants which live in the ground and seem to know the best constituents for their well-being, are perhaps the best chemists as far as regards the choice of their elements. M. G. Ville has examined and ascertained, by the aspect even, what elements exist in a sufficient quantity, and what are wanting in the soil to nourish the vegetable.

On the property of M. Payen, at Boncourt (Aisne), there is an experimental plot of ground which is quite perfect in its way, and which has already furnished important results. This piece of ground is laid out similarly to that of Vincennes, where, by the different chemical manures combined by the formulæ of M. Ville, we remark the same ascending scale of crops, from the weakest to the most luxuriant, without the law governing the culture having shown a single exception. Not far from the border of a road, in a flinty land of very bad quality, a plot was manured with 40 tons to the hectare; another parcel of the same ground received a *complete* manure of 400 kil. of superphosphate of lime, 200 kil. nitrate of potash. 250 kil. sulphate of ammonia, and 350 kil. of sulphate of lime—in all 1,200 kil.—

the cost of which was 325 francs per hectare. Stable dung produced a miserable crop of wheat; the chemical manure gave a splendid return. From a letter addressed to the *Journal de l'Aisne* we learn the following:—

A hectare of sand treated by the complete manure produced—

1. 28 hectolitres of wheat, at 27 francs,	756 f.	0 c.
2. Straw, 6,070 kilos., at 0 f. 4 c.,	242	80
3. Small straw,	4	
	1,002 f.	80 c.

The same ground treated with good farm manure, 40 tons per hectare. only produced—

Foreign Science 2.

1. 8 hectolitres, 50 litres at 27 francs,	229 f.	50 c.
2. Straw, 1,696 kilos. at 0 f. 4 c.,	67	84
3. Small straw,	1	50
	298 f.	84 c.

M. Al. Donne read a note on rotten eggs, and the manner of action upon the organic products which result from his collection of eggs. The following experiments, the ideas of which have been suggested by M. Balard, respond completely to the conditions of the problem. Old eggs are taken and well shook up so as to mix the yolk with the white; they are plunged into a vase, which is half filled with distilled water; the vase is put then under the receivers of an air-pump. While the vacuum is being made, small air bubbles cover the surface of the egg-shells, penetrating by the pores into the exterior air. The eggs are kept for many hours under the bell-glass without necessarily having a perfect vacuum. When a great portion of the gases of the egg have thus passed, air is let into the bell receiver; the vase is left, and the eggs remain in the water for four hours; the water penetrates into the egg, and by augmentation of weight it sinks deeper in the water; it is then drawn out, wiped, and left alone in an egg-cup. Eggs thus treated decompose and rot most easily; left in a stove at 30° or 35°C. in daylight (which is perhaps essential to the vitality), they exhale at the lapse of eight or fifteen days, perhaps three weeks, a fetid odour; often the same substance exudes through the pores of the shell. In another series of experiments—instead of leaving the eggs in the free air, M. Donne left some in water. In two or three days the water became turbid, and it was peopled with monads and vibrios visible by the microscope. The egg itself was rotten and presented no trace of animation.

M. Poznanski has recently investigated the effects of prussic acid administered in cases of cholera and intermittent fever, in which alteration and carbonisation of the blood takes place. Experiments on dogs and on cholera patients shew that half a drop of pure prussic acid suitably administered is well adapted for the treatment and cure of cholera. F. Moigno.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Nitric Acid in Water.—T. Fuchs determines nitric acid in water by the following method:—Two litres of water are boiled down to about 200 c.c., and during evaporation pure potassic permanganate is added, (the object of which is to convert nitrites into nitrates), until a permanent pink colour is obtained. The concentrated liquid is filtered, pure sulphuric acid added, and distilled into a flask containing baric carbonate suspended in water. The distillation is interrupted when sulphuric acid begins to go over. The contents of the receiver are filtered, and in the filtrate which contains baric nitrate and chloride, the barium is determined in the usual manner. The amount of chlorine being known from a separate experiment, all data are given for the calculation of the quantity of nitric acid present in the 2,000 c.c. water.

The error caused by the oxidation of ammonia to nitrous and nitric acid the author finds to be inappreciable.—(*Zeitschr. Analyt. Chem.* vi. 175).

Phosphoric Acid and Nascent Hydrogen.—R. Fresenius. It has been stated by Herapath (*Pharm. Journ.*, vii. 57) that phosphoric acid was reduced by zinc and sulphuric acid, so that hydric phosphide was mixed with the hydrogen evolved. Fresenius tried the experiment, but with a negative result. 100 grammes of zinc were slowly dissolved in diluted sulphuric acid in presence of 10 grammes of sodic phosphate. The gases after passing a small wash-bottle containing water were conducted through two U tubes filled with a neutral solution of argentic nitrate. A small quantity of black precipitate was formed, which on examination was found to contain arsenic and silver, but not a trace of phosphorus in any form. A similar experiment in which no phosphate had been added to the zinc gave the same result exactly.—(*Zeitschr. Analyt. Chem.* vi. 203).

Volumetric Determination of Iron.—A. C. Oudemans. The inaccuracies attached to the method of the direct determination of iron by means of sodic hyposulphite, as first proposed by Scherer, have been removed by the following modification of the process. To a solution of ferric oxide, which may contain much free chlorhydric acid, are added a few drops of a solution of a cupric salt, and potassic sulphocyanide sufficient to render the liquid dark red. A standard solution of sodic hyposulphite is then added until the red colour has entirely disappeared, which point may be observed with great accuracy. The action of the small quantity of cupric salt consists in causing a more rapid deoxidation of the ferric salt.

The analysis given in illustration of this method are very satisfactory.—(*Zeitschr. Analyt. Chem.* vi. 129).

Hypogaeic Acid.—K. Schröder. The oil, extracted from the seeds of aracnis hypogaea by means of carbonic disulphide, was saponified with sodic hydrate. The soap decomposed with chlorhydric acid, and the mixture of arachidic, oleic, and hypogaeic acid subjected to repeated crystallisations from alcohol, until the last-named acid was obtained in a state of purity.

Hypogaeic dibromide, $C_{16}H_{30}Br_2O$, is obtained by the action of bromine on the acid at a low temperature. This bromide, on being treated with alcoholic potassic hydrate at 100°C., is converted into monobromhypogaeic acid, $C_{16}H_{29}BrO_2$; when the reaction is made to take place under pressure and the temperature raised to 170°, palmitolic acid, $C_{16}H_{28}O_2$, a lower homologue of stearolic acid is formed, the decomposition taking place according to the equation:

$$C_{16}H_{30}Br_2O + 2KHO = C_{16}H_{28}O_2 + 2KBr + 2H_2O.$$

Monobromhypogaeic acid again treated with bromine is converted into monobromhypogaeic dibromide,

$$C_{16}H_{29}Br_3O_2,$$

and this when digested with alcoholic potassic hydrate is changed into monobrompalmitolic acid,

$$C_{16}H_{27}BrO_2.$$

Fuming nitric acid oxidises palmitolic acid to suberic acid, suberic hydride, and palmytoxylic acid:

$$2C_{16}H_{28}O_2 + 7O = \underset{\text{Palmitoxylic acid.}}{C_{16}H_{28}O_4} + \underset{\text{Suberic acid.}}{C_8H_{14}O_4} + \underset{\text{Suberic hydride.}}{C_8H_{14}O_3}$$

Freshly precipitated argentic oxide and water acting upon hypogaeic dibromide at 100° convert it into oxyhypogaeic acid, and the latter, on being boiled with an alkaline hydrate takes up water, forming dioxypalmitic acid:

$$C_{16}H_{30}Br_2O_2 + Ag_2O = C_{16}H_{30}O_3 + 2AgBr,$$

and oxyhypogaeic acid

$$C_{16}H_{30}O_3 + H_2O = C_{16}H_{32}O_4$$

dioxypalmitic acid.—(*Ann. Chem. Pharm.* cxliii. 22).

NOTICES OF BOOKS.

The Calendar of the Pharmaceutical Society.

Pharmaceutists will find this book of great value as a reference on all matters connected with the Society. In addition to the list of members and associates which was formerly published in the July number of the Journal, it contains the various Acts of Parliament relating to Pharmacy, the regulations of the Board of Examiners, the rules of the Benevolent Fund, and much that will be useful to those interested in Pharmaceutical matters.

CORRESPONDENCE.

DR. CLAUS ON SUCCINIC ACID.

To the Editor of the Chemical News.

Sir,—Permit me a few words in reply to Dr. Claus's communication to your paper of last week.

Dr. Claus wishes it to be understood that I made two unconditional assertions with reference to two particular points noticed in my paper "On some Metamorphoses of Oxalic Acid." I affirm that I did not make these two unconditional assertions. On the contrary, I gave it to be understood that my results as to (1) the existence of an isomer of acetic acid, and (2) the conversion of succinic into butylactic acid, were not sufficiently complete to warrant any positive assertion. In the case of the supposed isomer of acetic acid I expressly said—"If the preliminary examination of these substances has conducted me to a correct conclusion, and I am right in supposing the last-mentioned acid to have the formula assigned to it, we have a new isomer of acetic acid." Dr. Claus ingeniously omits the word "and" in his quotation, thus making me say "I am right, &c." I ask you, Mr. Editor, is this omission honest? If it be not a printer's or clerical error, Dr. Claus either does not know the significance in English of such an omission, or he knows it too well.

With reference to butylactic acid, I stated my examination of the product in question to be merely qualitative. I certainly intended my remark as to its being premature to express any opinion as to the composition of my products, to apply to the supposed butylactic acid. While stating that the properties and salts of the acid I obtained did correspond with those of the true acid, I affirmed nothing concerning its composition, not having submitted it to analysis.

Dr. Claus accuses me of certain omissions in my letter to the *Laboratory*. My letter, which you quote, contained naturally those paragraphs only of my original paper which showed the reservation I had felt it necessary to make: fuller extracts would have been out of place; nor have I newly expressed any opinion as to the correctness of my original results and anticipations. I will indeed acknowledge freely any errors I may have committed.

I hardly care to refer to the uncourteous tone of Dr. Claus's letter, or its offensive inuendoes. What occasion can Dr. Claus have for telling your readers that he promises never more to quote any of Mr. Church's communications or to believe them? Does he wish me to say how deeply such a terrible threat grieves me, and that I have in consequence no longer any incentive to chemical work?

Dr. Claus supposes that I never thought my answer would come into his hands. Is not this supposition perfectly gratuitous? On what shadow of foundation does it rest? It is not only gratuitous but foolish. Dr. Claus says, moreover, that I have denied my own words. He says this, but his attempts to prove it will I am sure be generally considered ineffectual. I have quoted my own words, not denied them.

But it is not worth while to argue concerning these matters with a disputant who descends to offensive personalties. If his position were a strong one he would not need them: a weak position they will not avail to strengthen.—I am, &c.,

A. H. Church.

Cirencester, October 21, 1867.

VOLATILITY OF SESQUICHLORIDE OF IRON.

To the Editor of the Chemical News.

Sir,—After reading Mr. Skey's note on the volatility of sesquichloride of iron at common temperatures, given in last week's Chemical News, I tried some experiments upon the subject. Without at present in any way disputing the fact, I would draw the attention of this gentleman to a possible source of error. In my experiments I found that the vapour from pure hydrochloric acid caused a faint tint in an aqueous solution of the ordinary crystals of sulphocyanide of potassium.

M. Stas states that hydrochloric acid evaporated in an open vessel becomes contaminated with impurities; and an examination made by myself has shown the presence of iron in the light particles of dust deposited on the upper shelves of lofty rooms. It may be safely stated, then, that minute particles of iron are continually floating about in the atmosphere.

Now, considering the great delicacy of the test, and the excessively small quantity of iron necessary to effect colouration in a solution of an alkaline sulphocyanide, it must surely be difficult to prepare on a manufacturing scale crystallised sulphocyanides which will not give a faint pink tint by contact with hydrochloric acid.—I am, &c.,

Henry Seward.

CHEMICAL PATENTS.

To the Editor of the Chemical News.

Sir,—I write for information, or, at all events, to throw some light upon a critical expression of yours, which under slight modification is not uncommonly to be met with in the pages of the Chemical News. To quote an instance of this remark in illustration,—I may state that having been recently engaged in a controversial dispute, in another journal, as to the originality of a certain invention for producing chlorine, and my opponent having referred in condemnatory terms and for reasons of his own to a totally different patent of mine, viz., "for improvements in the manufacture of inflammable gases," he makes an extract in support of his views from the columns of some *un-named* authority; but having already seen the remark myself, I know that authority to be the Chemical News. The extract referred to is the following:—You say, speaking of my patent—"This is another case of patenting well known chemical processes." Now, Sir, having already stated that I seek for information, will you be so kind as to furnish me and your readers generally with other than a very exceptional list of chemical patents which are not founded on well-known chemical processes? Take for instance Howard's or Scoffern's patents for refining sugar. The remarkable power possessed in so high a degree by animal charcoal of absorbing colouring matters, as well as the coagulative property of serous albumen when heated beyond 140°F., were facts I apprehend as thoroughly known as was the abstract physical principle of the vacuum pan prior to the date of the first of these patents; as was also the depurative power of acetate of lead, anterior to the date of the second patent. Again, and taking at random another invention out of many. In "Brankart's Patent Copper Smelting Process,"—the chemical facts upon which this patent rests were thoroughly well known before they were applied to this specific purpose by the inventor. Was it not known

that sulphide of copper roasted under certain conditions would produce sulphate of copper, and that such sulphate of copper, when dissolved, would by the superior affinity of iron throw down the copper in a metallic state, and by the appropriation of the negative elements present produce sulphate of iron or copperas? Take another instance. Mr. Gill a few years since invented a lamp without flame in which a cylindrical coil of platinum wire, the hundreth part of an inch in diameter, and making about ten turns, was maintained in a state of incandescence by the vapour of alcohol. The chemical principle here was also old, having been discovered years before by Sir Humphry Davy. I do not suppose I have selected the happiest illustrations of the application of known chemical principles to useful purposes, but they will at least serve to prove my position, namely, that in innumerable instances, what are called chemical inventions, and are recognised by the law to be legally such in the abstract, and therefore sound and patentable, are all more or less so many other cases of patenting well known chemical processes. It is true that instances may be occasionally brought forward where a chemical or physical *discovery* is recorded for the first time in the specification of a patent, securing its *application* to some useful purpose; but this is the exception to the rule, and not the rule itself.

And again, it occasionally occurs that a chemical principle is so well known in its application to any particular purpose that a patent will only hold good by claiming certain specific machinery or apparatus as applied thereto. Where, however, such is not the case, where a useful and economical result is obtained by combining several separate but well known chemical principles together, in consecutive order, so as to constitute what may be termed a circle of affinities, and to lead to important manufacturing results not hitherto obtained,—then I think the judgment of the general reader should not be warped, the co-operative power of capital suspended, nor the criticism of the malicious invited. First, by sweeping the bulk of chemical patents into one condemnatory sentence, and saying of each in succession as it appears—"This is only another case of patenting well known chemical processes"—as though there were really no novelty whatever in the case, either as to *method* of operation or useful *results*.

The reason that induces me to speak is that such remarks are calculated to do considerable injury, and rests, as it appears to me, on no solid or legal foundation.—I am, &c.,

ISHAM BAGGS.

54, Chancery Lane.

OZONE.

To the Editor of the Chemical News.

SIR,—The following is an account of the development of ozone during July, August, and September:—

In July there were periods with very little ozone from the 1st to the morn. of the 3rd, from the 5th to the morn. of the 13th, on the aft. of the 16th, morn. of the 18th, from the 19th to the 21st, from the aft. of the 23rd to the 28th, and on the afts. of the 29th, 30th, and 31st. Considerable quantities of ozone were present on the aft. of the 13th, and from the 22nd to the morn. of the 3rd. Large amounts on the aft. of the 3rd and morn. of the 4th, from the 14th to the morn. of the 16th, on the 17th and aft. of the 18th, and on the morns. of the 29th, 30th, and 31st.

In August there were periods with very little ozone from the 4th to the morn. of the 5th, aft. of 7th, aft. of 9th to 11th, 15th, aft. of 19th and morn. of 20th, and from the 26th to the 31st. Considerable amounts on the morns. of the 8th and on the 21st. Large amounts on on aft. of the 5th, on the morns. of the 6th, 7th, and 9th, the the 14th, 17th, morns. of 18th, 19th, and aft. of 20th. There was a period of variable development from the 22nd to the 25th. In September there were periods with very little ozone from the 1st to the morn. of the 2nd, on the 3rd, morn. of the 8th, from the 9th to the 11th, aft. of 12th to morn. of 14th, 15th to morn. of 17th, from the aft. of the 19th to morn. of 21st, on the aft. of 22nd and morn of 23rd, morn. of 24th, and from the 25th to the 28th. Considerable quantities on the morn.of 12th, morn. of 19th, aft. of 24th, and aft. of 30th. Large amounts aft. of 2nd, 4th to morn. of 7th, aft. of 8th, aft. of 14th, aft. of 17th, to 18th, aft. of 21st and morn. of 22nd and 29th to morn. of 30th..—I am, &c.,

R. C. C. LIPPINCOTT.

Bournemouth.

RECOVERY OF SULPHUR FROM ALKALI WASTE.

To the Editor of the Chemical News.

SIR,—In your impression of 26th of July, 1867, in an article on the recovery of sulphur from alkali waste, by Ludwig Mond, that gentleman says "the most successful of them has probably been that of Mr. Benjamin Jones, a workman who assisted me in working my process out on a large scale in 1863, at the works of Messrs. Hutchinson and Co., Widnes. One of the three patents which he took out between December, 1863, and May, 1864, has been worked a short time in Warrington, but was, however, quickly abandoned."

Now, Mr. Mond must have been conscious at the time of writing the above, that I was not working at Messrs. Hutchinson's at the time to which he alludes, and I may add that I only know Mr. Mond by report, never having either seen or spoken to him, to the best of my knowledge.

It is true that my patent was worked for some time at Warrington, but the reason of its discontinuance was not through inefficiency of the process. I shall esteem it a favour if you will kindly insert this in your next impression.—I am, &c.,

BENJAMIN JONES.

Castle Hill, Hindley, near Wigan Lancashire, October 19, 1867.

MISCELLANEOUS.

Composition and Quality of the Metropolitan Waters in September, 1867.—The following are the Returns of the Metropolitan Association of Medical Officers of Health:—

Water Companies.	Total solid matter per gallon.	Loss by Ignition *.	Oxidisable organic matter ‡	Hardness.		Organic and other ammonia.
				Before boiling.	After boiling.	
Thames Water Companies.	Grains.	Grns.	Grains.	Degs.	Degs.	Grains.
Grand Junction .	17·80	1·15	0·56	13·0	4·0	0·001
West Middlesex .	17·47	1·50	0·52	12·5	4·0	0·003
Southwark and Vauxhall.	17·93	1·55	0·78	12·5	3·5	0·007
Chelsea	19·33	1·50	0·93	13·5	3·5	0·003
Lambeth	18·50	1·95	0·72	13·5	4·0	0.003
Other Companies.						
Kent	27·00	1·55	0·24	19·0	7·0	0·000
New River . . .	14·73	1·40	0·28	12·5	4·0	0·002
East London . .	17·91	1·60	0·48	12·5	4·0	0·003

* The loss by ignition represents a variety of volatile matters, as well as organic matter, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

‡ The oxidisable organic matter is determined by a standard solution of permanganate of potash—the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

Preservation of Stone.—This subject, which has attracted the attention of so many chemists, seems now to have been brought to a very successful point. We have received some specimens of chalk treated by a process discovered by Messrs. Dent and Brown, of the Chemical Department, Woolwich. Their process consists in the application of a solution of oxalate of alumina to the stone. The experiments date from December, 1865, and the results they have now obtained are most encouraging. The process is applicable to limestone, dolomite, and chalk, and may, we think, be made subservient to the preparation of lithographic stones. Oxalate of alumina is readily soluble in water, and the solution, which is simply applied with a brush, is made of a strength varying with the porosity of the material to which it is to be applied. The specimens we have before us are left in the original condition at one end, and have been prepared with the solution at the other. The physical characteristics of chalk so treated are—lightness, the possession of a glazed surface approaching somewhat in appearance marble, and greatly increases hardness; in this respect the stone is about equal to Fluor spar, or 4 in Mohs' scale. Furthermore, the lime being transformed into one of the most insoluble and unalterable of its compounds, and the alumina being precipitated, the pores are filled with a substance almost unacted upon by water or by the impurities present in the atmosphere of large cities. We should be glad to hear that the discoverers had one of the experimental bays of the Houses of Parliament placed at their disposal. They might thus prove their process to be a formidable rival to that of their colleague Mr. Spiller, which according to present appearances is likely to be the most successful of all the numerous schemes now *sub judice* at Westminster.

Sulphocyanide of Chromium.—When a mixture of bichromate of potash and sulphocyanide of potassium is treated with hydrochloric acid, the liquid acquires a reddish purple color, and on agitating it with ether, a red sulphocyanide of chromium is dissolved thereby, while the aqueous solution acquires a pure green colour. If the action of the sulphocyanide is further prolonged, the original purple red colour passes into green, and ether refuses to extract any of the chromium. It has since been found that by using a limited quantity of the sulphocyanide only the red colour is produced, and ether then extracts the whole of the chromium salt. From these circumstances it appears likely that the pleochroism exhibited by the solutions of various chromium salts is due to the presence of two different oxides of chromium, the green sesquioxide and a higher oxide. A double sulphocyanide of potassium and chromium appears to form when a solution of bichromate of potash is evaporated at a very gentle heat, with a small quantity of a sulphocyanide in hydrochloric acid. It falls in granular ruby coloured crystals.—*William Skey, New Zealand.*

Impermeable Oil Barrels.—The Titusville, Pa., *Herald* describes the process for rendering casks or barrels air-tight and impermeable to oil, spirits, turpentine, and all volatile fluid, that has been in operation in its vicinity for a year, with such good results. The barrel having passed from the finishing hands of the workmen, the process of permeating is in this wise. The barrel is placed over tubes through which hot air is injected into it for twenty-four hours, thoroughly heating the wood and opening the pores. Any worker in wood knows that glue will not stick to a cold surface as well as to a warm one, and this fact is a serious inconvenience in the old fashion of glueing barrels by hand. From these tubes the barrel is placed in a frame-work that braces the head, and allows it to revolve on either axis. Hot glue is poured into it, and distributed over every portion of the inner surface. A tube is then introduced through the bung hole, and a pressure of twenty pounds of air to the square inch applied, forcing the glue into every crack and crevice and even the pores of the wood; so great is the pressure that the glue is often forced through the pores to the outside of the barrel. The package is then impermeable and as tight as a bottle.

PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent. 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2505. F. H. Pattison, and J. W. H. Pattison, Glasgow, N. B., "A new or improved metal-founders' blacking." Petition recorded.—September 4, 1867.

2571. W. Baker, Tipton, Staffordshire, "Improvements in the manufacture of iron, and in furnaces used in the manufacture of iron."

2577. H. R. Lückes, Coleford, Gloucestershire, "The manufacture of artificial or compressed fuel in the treatment of coal, peat, charcoal, tan, sawdust, and woody fibre, whereby those substances, either together or separate, can be utilized when in a state of powder or minute division, and converted into a serviceable fuel."—September 11, 1867.

2608. P. Dumont. Stoke Newington Road, Middlesex, "An improved manufacture of soap."—A communication from A. L. Labather, A. Bizet, and L. F. J. Lecat, Place Saint Jacques, Compeigne, France."—September 16, 1867.

2611. C. Holste, Henrietta Street, Covent Garden, Middlesex, "Improvements in blast furnaces."—A communication from F. Lürmann, Oesede, near Osnabrück, Prussia.—September 17, 1867.

2637. J. G. Willan, Saint Stephen's Crescent, Baywater, Middlesex, "Improvements in the manufacture of iron."—September 19, 1897.

2679. W. Beardmore, W. Brock, and A. C. Kirk, Glasgow, N.B., "Improvements relating to furnaces."

2685. A. Ziegele. Mincing Lane, London, "Improvements in the manufacture of Epsom salts."—A communication from Messrs. Vorster and Grüneberg, Cologne, Prussia.—September 23, 1867.

2711. R. W. Bennie, Glasgow, N.B.. "Improvements in the manufacture of moulders' blackening."

2721. J. Fordred, Blackheath, Kent, "Improvements in bleaching and purifying paraffin."—September, 26 1867.

2731. L. de la Peyrouse, Somerset Street. Portman Square, Middlesex, "Improvements in the treatment of paraffin, fatty, and resinous matters."—A communication from L. Krafft, Rue de L'Eglise, Neuilly, near Paris.—September 27, 1867.

2756. E. P. Alexander, Lincoln's Inn Fields, Middlesex, "Improvements in the manufacture of cast steel, and in furnaces to be employed therein."—A communication from F. Ellershausen, Ottawa, Canada.

2760. G. Allibon, Worcester, and A. Manbrê, Baker Street, Middlesex, "Improvements in apparatus applicable to the conversion of cereal and vegetable substances into saccharine matter, in treating and purifying saccharine substances extracted from malt, fruits, and vegetables, in treating fatty matters, and in the manufacture of chemical products."—October 1, 1867.

2782. H. D. Pochin, Salford, Lancashire, and E. Hunt, Manchester, "An improvement in the construction of furnaces, flues, and vessels which are subjected to high temperature."—October 3, 1867.

2801. J. Anderson, Londonderry, Ireland, "Improvements in obtaining chlorine, sodium, potassium, phosphorus, and their compounds" —October 6, 1897.

2816. C. D. Abel, Southampton Buildings, Chancery Lane, "A new or improved process and apparatus for refining camphor."—A communication from C. E. Perret, Boulevard de Strasbourg, Paris.

2819. D. Swan, jun., Mary-hill, Lanarkshire, N.B., "Improvements in the manufacture of zinc."

2822. J. H, Brown, Romsey, Hants, "Improvements in utilising refuse animal matters, and producing skins and sheets therefrom." October 7, 1867.

NOTICES TO PROCEED.

1646. E. Meldrum, Bathgate, Linlithgow, N.B., "Improvements in the purification of paraffin."—Petition recorded June 4, 1867.

1652. N. Rausch and E. L. Darlet, Brussels, "Improvements in the manufacture of artificial fuel."—June 5, 1867.

1752. W. E. Newton, Chancery Lane, "Improvements in the preparation of pulp for the manufacture of paper."—A communication from A. Aussedot, Rue St. Sebastien, Paris.—June 15, 1867.

2102. C. Klug, Regent Street, W., "An improvement in the preparation of chocolate and cocoa."—July 17, 1867.

2395. C. W. Siemens, Great George Street, Westminster, "Improvements in furnaces, and in processes and apparatus in connection therewith, principally applicable to metallurgical operations."—August 21, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Dingler's Polytechnisches Journal.

June.

J. P. REININGHAUS, "An Apparatus for Measuring and Regulating the Supply of Fluids." G. BISCHOF, JUN., "On the Colorimetrical Estimation of Copper." C. THIEL, "On the Preparation of Meat Biscuits." C. SIMEONS, "On the Manufacture of Articles in Mica by M. Raphael, of Breslau."

June.

C. KUHN, "On Pouillet's Method of Applying Lightning Conductors to Powder Magazines." G. LUNGE, "Notes on Technical Chemistry: 5. On the Manufacture of Bone Black, Sulphide of Ammonium and Super-phosphate of Lime." R. BRIMMEYER, "Notes on Technical Chemistry: 5. On the Decolourising power of Bone Black." 6. On the Aniline Dyes at the French Exhibition." R. WAGNER, "On the Detection of Woollen Fibres in Silk Yarn and Fabrics."

L'Invention.

July.

POIRRIER AND CHAPPAT, "On a Method of Manufacturing Dyes by the Action of Alcohols on Aniline." HOLLIDAY, "A new Process for producing Red and Violet Aniline Colours." DANGEVILLE AND GAUTIN, "A process for discharging Aniline Colours from Fabrics." QUENEAU, "On the Use of Crude Limestone for disinfecting Beet Juice." JUNEMANN, DU RIEUX, AND ROETTGER, "On the Extraction of Sugar from Saccharine Solutions by means of Lime." HEURTEBISE, "On an Economical Process for producing Hydrogen Gas by Heating Carbonic Oxide in Contact with Superheated Steam."

Génie Industriel.

July.

E. FIEVET, "On Measuring Temperatures." SCHINZ, "An Improved Pyrometer"

Comptes Rendus.

August 5, 1867.

FAYE, "On the Influence of External Causes on the Formation of Sun Spots." H. TARGIONI-TOZZETTI, "On the Wax of *Coccus caricæ*." V. POULET, "On the Presence of Infusoria in the Breath of Persons suffering from Whooping Cough."

August 12.

SIR DAVID BREWSTER, "On the Authenticity of the Newton and Pascal Correspondence." CHASLES, "On the Authenticity of the Newton and Pascal Correspondence." DUHAMEL, "On the Authenticity of the Newton and Pascal Correspondence." E. HOPKINS, "On a Method of destroying the Magnetic Polarity of Iron Ships." WOLF AND RAYET, "On the Spectra of Tnree Stars in the Constellation Cygnus." P. VOLPICELLI, "On the Correlations of Galvanometers and of Gauss' and Lamont's Methods of Calculating the Horizontal Intensity of the Earth's Magnetism."

Monatsbericht der Königlich-Preussischen Akademie der Wissenschaften zu Berlin.

May, 1867.

W. FORSTER, "On the Influence of the Density of the Air on the Rate of a Clock, especially on the normal Clock of the Berlin Observatory, and on the Performance, when enclosed in an Air-tight Casee, of an Electro-magnetic Clock made by F. Tiede." POGGENDORFF, "On the Development of Heat in the Path of the Electric Spark."

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften zu Wien. (Mathematisch-naturwissenschaftentische Classe).

February, 1867.

S. STRICKER; "Researches on the Vitality of the Colourless Blood Corpuscles in Man." F. ROCHLEDER, "Note on the Constituents of the Root Bark of the Apple Trec." J. F. SCHMIDT, "On the Recent Changes in the Crater of *Linnæus*.

Sitzungsberichte der Königlich-Bayerischen Akademie der Wissenschaften (Mathematisch-physikalische Classe).

January 12, 1867.

VOGEL, JUN., "On Washing, Pressing, and Preparing Peat." VON GORUP-BESANEZ, "On Pyrocatechine, a product of the Action of Iodine and Phosphorus on the Rhenish Beech Wood Tar Creosote.

Poggendorff's Annalen der Physik.

No. 5, 1867.

H. KNOBLAUCH, "On the Interference Colours of Radiant Heat." L. PFAUNDLER, "Contributions to Chemical Statics; being an Attempt to explain the Phenomena of Dissociation and Affinity according to a new Theory." J. PHILLIPP, "On the Action of Sulpho-cyanide of Potassium on the Salts of Merdury." E. LOMMEL, "On the Cause of the redness of the Sky in the Evening, and of some Phenomena in connection therewith." A. HAAGEN, "A Determination of the Refractive Index and Specific Gravity of some Liquid Haloid Compounds: Tetrachloride of Carbon, Chloroform, Chloride of Ethylene, Bromide of Ethyl Bromide of Amyl. Bromide of Ethylene, Iodide of Methyl, Iodide of Ethyl, Iodide of Amyl, Bisulphide of Carbon, Chloride of Sulphur. Terchloride of Phosphorus, Terchloride of Arsenic, Pentachloride of Antimony, Chloride of Zinc, Chloride of Silicium, and Chloride of Sodium, *à propos* of the Question of the Refractive Equivalent of the Elements." E. SCHOENE, "Note on Crystallised Hydrate of Potassium." P. RIESS, "On the Cause of the Undulations produced in Metallic Wires bs the Electric Discharge." G. QUINCKE, "Remarks on L. Daniel's Paper, published in the *Comptes Rendus* of May 11, 1867, on the Transport of Matter by the Voltaic Current." KINDT, "On the Spectrum of the Phosphorescent Light of Phosphorite, Clorophane, and other Varieties of Fluor Spar."

NOTES AND QUERIES.

Gun Cotton.—Can any of your readers inform me what works have been published upon the new explosives, nitro-glycerine, gun-cotton, and Scheeltzes wood gunpowder, and if any and what chemical authorities have reported upon them?—K.

Transparency of Red Hot Metals.—Sir,—I noticed a short time since, in one of the numbers of the CHEMICAL NEWS, some letters on the transparency of red hot metals. A few weeks ago, I went over some steel works in the North of England, and there the manager spoke of it as a well-known fact that steel at a white heat was transparent. In proof of it he showed that, when the molten metal was being poured out, the edge of the crucible appeared to be distinctly visible through the molten metal. This could only be seen directly the crucible was taken out of the furnace, before it had cooled in the least. If the metal is not transparent will any of your correspondents say whether this appearance can be accounted for in any other way?—EXON.

Bleaching Palm Oil.—Sir,—Would you oblige me by giving me some information through the medium of your Notes and Queries column in reference to "Bleaching Palm Oil." I am connected with a works at which palm oil is used, and occasionally it is required to be bleached. I have applied myself to the task of bleaching it with only indifferent success; I follow (as I believe) the method once patented by Mr. Watt. I first introduce the orange coloured oil into a tub open at the top into which an open steam jet is conducted, I allow the steam to blow into it until its temperature marks 130 deg. or 134 deg. F. I then add to the oil a saturated aqueous solution of 1 lb. commercial "Bichrome" for each cwt. of oil to be operated upon, as nearly the same temperature as the oil as possible. I then add a quantity of hydrochloric acid (commercial) equal in weight, as nearly as I can guess, to double the weight of bichrome before being dissolved. I then agitate the mixture with a paddle, and the characteristic odour of nascent oxygen is quickly perceptible, which continues to emanate for 1½ or 2 hours without decolourising the oil to any sensible extent, the agitation being kept up the whole of the time. Parnell describes this process as requiring only five minutes for decolourising the oil. I must therefore be most egregiously at fault, for even after the expense of so much labour the product is not at all satisfactory. I have even employed double the quantity of the bleaching agents with no better success.—GEO. JOHNSON.

TO CORRESPONDENTS.

Enquirer.—The report has been long out of print.

F.—A letter will be sent if you leave the address at our office.

Theta.—Hayesite is another name for Boronatrocalcite.

J. H. Salis.—Send particulars, and our printer will give you an estimate for printing the pamphlet.

S.A.Y.—No process is yet known for the quantitative separation of the two metals.

Distiller (O. J. Q.)—Bisulphide of Carbon has been found in many specimens of American Petroleum. The portion distilling below 80 degs. C. contains nearly all.

James Peterson.—Artificial lithographic stones have been made in France, but we know not with what success. Their manufacture should not present any insuperable difficulty. All would depend on the demand, and price willing to be paid. Send a specimen of what you have produced.

F. Garland.—You will probably find a paste made of starch, glycerin, and plaster of Paris, answer your requirements. It will retain its plasticity and adhesivcness longer than most other cements.

W. O. Lever.—The impurity has got into your test solution from the glass bottle in which it has been kept. This is a far more frequent source of impurity in reagents than many chemists would imagine.

Books Received.—"The Nation" for October 10, 1867. "The CHEMICAL NEWS," American Reprint, Vol. I. No. 4, for October 1867. "Silliman's American Journal of Science" for Sept. 1867. "The Standard." for October 21 and 22.

Communications have been received from W. Chapman; J. Johnson; Professor Gustavus Hinrichs (with enclosure); W. Y. Dent; Miss Becker (with enclosure); W. A. Townsend and Adams; J. Seeley (with enclosure); Professor A. H. Church (with enclosure); D. Forbes, F.R.S. (with enclosure); Dr. W. A. Miller F.R.S.; Henry Seward; J. D. Munro; W. Mackic; William Rogers (with enclosure); A Francis; W. Hickman; J. Jelley; E. Delafield; W. Thomas (with enclosure); Rev. B. W. Gibsone; John Parnell (with parcel) Mr. Thorne; R. Campbell, jun., Canada; "Enquirer"; W. Sugg C. Mullingbach (Hanover); Arthur Warner; C. R. Wright (with enclosure); H. Greenwood (with enclosure); Alment and Johnson (with enclosure); W. Preece (with enclosure).; Bailey and Son (with enclosure).

THE CHEMICAL NEWS.

Vol. XVI., No. 413.

ON THE

MANUFACTURE OF SALTPETRE.

By J. H. SWINDELLS.

I have lately examined several lots of refuse (muriate of soda, &c.,) from various saltpetre makers, and find a serious loss of potash and other materials. The refuse from saltpetre works is mostly sold for manure, either alone or mixed with other substances. From the analysis I give below it will be seen that this refuse in many cases contains a large amount of potash, &c., thus showing bad and careless working.

Analysis of muriate of soda.

Muriate of soda, ...	70·50
Muriate of potash, ...	8·81
Nitrate of potash, ...	6·15

The rest was made up of sulphate of lime, insoluble matter, and water. Another sample showed very near working; it gave me

Muriate of soda, ...	97·13
Nitrate of soda, ...	1·10

Insoluble matter, sulphate of lime, &c., formed the remainder.

Twelve samples of refuse gave me an average of 5·6 per cent of potash lost in working. Several samples gave me a large amount of insoluble matter, owing, I should imagine, to the "sweeping up" of the factory and to the muriate of potash, which in many cases I know contains a larger amount of foreign matter than it ought to do, although it is sold, generally speaking, with a guarantee that it contains "80 per cent."

I will now give a short account of the method generally followed in the manufacture, and a recommendation of my own to prevent loss of materials. In all the manufactories I have been able to visit the process was as follows:—A certain weight of muriate of potash and nitrate of soda was put into an iron pan along with a quantity of water. The steam was then blown into the "mixture," which is stirred about till such time as it is thought the muriate and nitrate are dissolved. The liquid is then run or syphoned into a tank, and after a certain time the resulting crystals are removed, and invariably refined. The last process is simply done by dissolving down the crystals and re-crystallising. I found that no hydrometers were used for ascertaining the density of the liquids, but that everything was done on the "guess" principle. By following this process a loss will always occur; for how is it possible to tell when all the materials have thoroughly dissolved? Moreover, it takes a longer time to dissolve the materials together than it would occupy if the muriate and nitrate were dissolved separately.

The chemical action is too well known to be described here; I will, therefore, proceed to consider the best way of preventing any loss of materials. I would recommend that the muriate of potash should be dissolved in as little water as possible; then dissolve the nitrate of soda also in as little water as may be convenient, add the two solutions together and boil for one hour or so. This will precipitate a portion of the muriate of soda, which may be "fished" out of the pan, the liquid will now be found to have a specific gravity of about 1·200, 1·250, or 1·275, according to the manner in which the "dissolving and boiling" down is conducted. The liquid, after remaining at rest 2 hours or so, may be run into the coolers in the usual way to allow the nitrate of potash to crystallize out of the liquor; of course all the nitrate of potash does not crystallize out. A quantity remains in the "mother liquor," a portion of which may be used for dissolving the raw materials. The mother liquor, however, should not be too strong, as neither the muriate nor nitrate dissolve well in strong mother liquor; about 15 Twaddell will be found about the strength. When the "mothers" begin to increase and become too many for "dissolving" purposes, they must be salted down and crystallized. This is done by placing them in an evaporating pan, and boiling them down to about 35°, or so, Twaddell; care must be taken to remove the muriate of soda as it falls to the bottom of the pan. This may be done by means of perforated ladles. There is sure to be a little nitrate of potash clinging to the muriate of soda, and the manner of separating this must be considered. Even when there is so much as 5 per cent of potash mixed with the muriate of soda, it will scarcely pay to extract it, unless coals are very cheap; for the entire mass would have to be dissolved, and the liquor evaporated down to the crystallizing point. I would recommend the following plan:—As the muriate of soda is taken out of the pans it should be placed in a strong tub with a kind of filter bottom—this tub to be provided with a tight fitting top, through which a pipe passes for the admittance of steam. After the muriate of soda has been put in this tub and the top secured, the steam is blown through the mass for 15 minutes, and the liquor run off by means of a tap placed at the bottom of the tub. This liquor may be used for dissolving the raw material, and all over and above that required for this purpose must be evaporated down along with the mother liquor. By all means, the manufacturer, if he is not capable of making his own analyses, should have analyses made from time to time of his muriate of soda; he will then be able to form the best opinion of what he is doing, and thus avoid any unnecessary loss. Owing to the low price of saltpetre, very close working is required to make the business pay, and adulteration is coming much into vogue. The adulteration is practised by the manufacturer, and the saltpetre also meets with sophistication after it leaves his hands. The most glaring adulteration is common salt and alum. The muriate of soda from saltpetre making, is cleansed and mixed in the proportion of 2 cwt. to the ton of petre. In the process of refining the saltpetre, from 2 to 3 cwt. of alum is sometimes used. Nitrate of potash adulterated like this will not of course do for the gunpowder makers, but for many other purposes this adulteration often passes unnoticed.

ON SESQUISULPHATE OF IRON AND FERRIDCYANIDE OF POTASSIUM AS A TEST.

By EDWIN SMITH, M.A.

Having occasion to explain to my class the deoxidizing property of sulphurous acid, it occurred to me that the property in question might be illustrated by exposing a slip of bibulous paper, dipped in a mixed solution of sesquisulphate of iron and ferridcyanide of potassium, to the vapour rising from a bit of sulphur burning in air. For should the persalt of iron be reduced to a protosalt by giving up an equivalent of oxygen to the sulphurous acid, a blue reaction ought to take place with the ferridcyanide of potassium present in the solution. I tried the experiment, and the colour of the paper was instantly changed to a beautiful blue. A solution of sulphurous acid, or of a sulphite or hyposulphite, gives the same result; while only a very slight greenish tinge is imparted to the mixture by a sulphate, except in the case of protosulphate of iron. With this exception, a useful test seems to be afforded between sulphites and sulphates. I find the same test will discriminate a nitrite from a nitrate. To the mixed solution of sesquisulphate of iron and ferridcyanide of potassium

add a few drops of nitric acid; then add a little of the solution to be tested. If the latter contains a nitrite, a greenish blue precipitate will begin to fall, and quickly increase; if a nitrate, only a slight greenish tinge will be imparted to the test. Nitric oxide or nitric trioxide passed into the mixed solution throws down the same characteristic precipitate, which is produced by the decomposition of a nitrite in the previous case. Carbonic oxide will act in the same way, and if a slip of paper dipped in the test-mixture be held over the clear part of a bright coal fire, it turns blue with the carbonic oxide or sulphurous acid there given off. Again, if a bit of phosphorus is dropped into a little of the test in a a porcelain dish, the phosphorus immediately becomes coloured a greenish blue, and on stirring about, gradually imparts the same tinge to the solution. Phosphorous acid may be discriminated from phosphoric acid, just as sulphurous acid was distinguished from sulphuric acid, by the blue reaction with our test. Thus also phosphites are distinguished from phosphates. A solution of phosphorous acid showed the reaction readily on being shaken up with the test. Lastly, if copper turnings are boiled in the latter for a few minutes, a greenish blue tint is imparted to it, which becomes gradually deeper with the oxidation of the copper and the consequent reduction of the persalt of iron to the state of a protosalt.

ON A

COMPOUND FORMED BY THE DIRECT UNION OF ALDEHYDE AND ANHYDROUS PRUSSIC ACID.

By MAXWELL SIMPSON, M.D., F.R.S., and A. GAUTIER, M.D.

The synthesis of alanin from aldehydate of ammonia, prussic and hydrochloric acids, and the formation of lactic acid by the action of the same acids upon aldehyde in presence of water, render it highly probable that an intermediate body exists, resulting from the direct combination of hydrocyanic acid and aldehyde. It is this body which forms the subject of the present memoir.

If one molecule of anhydrous prussic acid is added to one molecule of dry aldehyde, contained in a mattrass surrounded with a freezing mixture, the two liquids mix without combining chemically, and their chemical combination is not accelerated by heating at 100° C. If, however, we leave them in contact for ten or twelve days, at the ordinary temperature of the air, they gradually unite, forming a perfectly transparent and colourless liquid. On subjecting this to distillation it was observed that hardly a drop passed over at 100°, although we operated upon a large quantity of liquid (34 grms.), a small quantity between 160° and 174°, and the remainder of the liquid between 174° and 185° C. On re-distilling the latter portion, in order to fractionate it, it was found that the greater part passed over at about 183° C. Notable quantities of the liquid, however, came over between 40° and 60° C., consisting principally of the parent bodies which had been dissociated by the simple vaporisation of the liquid. On leaving these bodies thus disassociated once more in contact for some days the point of ebullition rose, as before, to 183° C. The fractions boiling at 180°, and between 183° and 184 C. gave, on analysis, the following results:—

Product boiling at 180° C.	Product boiling between 183°-184°.	Theory. CNH,C_2H_4.
C 49·78	51·70	50·71
H 7·44	7·64	7·04
N 20·42	,,	19·83

These analyses prove that the body in question results from the direct combination of one molecule of aldehyde and one molecule of anhydrous prussic acid, or at least of equal numbers of molecules of these bodies, and that its point of ebullition is intermediate between 180° and 184°. We have tried the above experiments on mixtures containing the two generating bodies in various proportions, but always with the production of the same body. The name we propose for this compound is cyanhydrate of aldehyde, which is simply founded upon its synthetical formation.

Properties.—The cyanhydrate of aldehyde is a colourless liquid, having a faint odour of its generators; it has a bitter and acrid taste; it does not crystallise at = 21° C., but becomes syrupy. It can bear the temperature of 150° for a considerable time without suffering decomposition; at 180°, however, slight dissociation commences, and the liquid must be rapidly distilled in order to avoid the loss of a considerable quantity. It is soluble in all proportions in water and alcohol. It may be heated with water in a sealed tube to 150° C. without suffering the slightest decomposition, and the entire liquid can be recovered by distillation. Caustic potash appears to separate it into its two generators, forming cyanide of potassium and resin of aldehyde. A little ammonia is also evolved, owing, probably, to the decomposition of the cyanide of potassium.

Gaseous ammonia is absorbed by this body, with the production of a base, which gives a precipitate with bichloride of platinum. Our analyses of this salt have not yet enabled us to ascertain the composition of the base.

A strong solution of hydrochloric acid acts with great violence at the ordinary temperature of the air upon cyanhydrate of aldehyde. If, however, the cyanhydrate is introduced into a balloon surrounded with a freezing mixture, and the hydrochloric acid added gradually, the two liquids mix without any reaction taking place. On removing the open balloon from the freezing mixture, and placing it in water at the ordinary temperature, the reaction soon commences, and proceeds gradually till the entire liquid becomes a mass of crystals. These were twice treated with absolute alcohol, and the alcoholic solution evaporated, in order to separate the chloride of ammonium which is formed. A syrupy liquid was thus obtained, which was saturated at 100° C. with pure oxide of zinc and filtered. The filtered liquor gave, on cooling, a mass of beautiful prismatic crystals. These were recrystallised, heated in an oil-bath to 150° C., and analysed. The numbers obtained prove that the body in question was the lactate of zinc, as will be seen from the following table:

Experiment.	Theory. $C_3H_5Zn'O_3$.
C 29·84	29·63
H 4·52	4·3
Zn 26·77	26·75

The following equation explains the formation of this acid.

$$C_2H_4O,HCN + HCl + 2(H_2O) = C_3H_6O_3 + NH_4Cl$$

The insolubility of this salt in alcohol, its non-decomposition at 150° C. (sarcolactate gives off vapours at this temperature), and its crystalline form, sufficiently prove that it is the ordinary lactate of zinc, and not the sarcolactate.

The cyanhydrine of aldehyde is, then, isomeric, and not identical with the cyanhydrine of glycol of Wislicenus, seeing that it gives ordinary lactic acid with hydrochloric acid, and that it is converted into a resin by potash instead of giving sarcolactic acid. Moreover, the cyanides of the glycols have no disposition to evolve prussic acid and cannot be obtained in quantity and in a state of purity, whereas our body can be found in any quantity and perfectly pure.

We have endeavoured to obtain the vapour density of this body by Dumas' method, but without success. On heating the balloon containing our body till 210° in an

oil-bath and removing it from the bath, we observed that the aldehyde had been converted into a resin. On deducting its weight from the weight of the balloon the density of the vapour approached very near that of prussic acid. It appears to us, however, to be sufficiently proved that this compound only contains one molecule of each of the parent bodies, from the facts that it gives lactic acid with hydrochloric acid, and that it separates by the action of heat into prussic acid and ordinary aldehyde, and not into aldehyde or paraldehyde.

It appears to us that time is a very striking example of an organic body which is dissociated by heat and reconstructed by time.

NOTE ON THE

ACTION OF PEROXIDE OF MANGANESE UPON URIC ACID.

By C. GILBERT WHEELER.

THE oxidising action of a peroxide upon organic substances varying to some extent according to the peroxide employed, I have investigated the action of peroxide of manganese upon uric acid.

If uric acid and peroxide of manganese are heated together with a like quantity of water, and sulphuric acid is added in small portions at a time until no further action is to be observed, the black pasty mass then filtered, and the filtrate evaporated to about one-fourth of its original volume, there is obtained after considerable time, a quantity of large hexagonal crystals, which by analysis and characteristic re-actions was found to be parabanic acid.

If uric acid is heated with a large quantity of water only, until the latter is brought to the boiling-point, and then peroxide of manganese added as long as evolution of carbonic acid occurs, and the mass filtered, there remains on the filter peroxide of manganese and oxalate of manganese, while the filtrate on being somewhat concentrated yields crystals, which if again dissolved and treated with animal charcoal may be obtained colourless and quite pure. They were tasteless, rather difficultly soluble in cold but readily soluble in warm water; the solution gave with chloride of mercury no precipitate, while a very voluminous one was obtained on adding the nitrate of the same base; nitrate of silver and ammonia gave a white glistening precipitate; on heating, cyanide of ammonium was evolved.

0·3595 gramme yielded on combustion 0·133 water and 0·398 carbonic acid; which relation indicated the substance to be *allantoin*.

	Found.	Theory.
C	30·13	30·4
H	4·09	3·8

The mother-liquor contained much urea; also an amorphous substance, the quantity of which was too trifling to admit of an analysis. The action of the peroxide of manganese may be explained by the following equation.

$$3(C_{10}H_4N_4O_6)+6MnO_2+8HO=2(C_8H_6N_4O_6)+2(C_2O_3H_4N_2)+4(MnO,C_2O_3)+2(MnO,CO_2).$$

If uric acid is heated with peroxide of manganese in the presence of but a small quantity of water there is formed urea, oxalic and carbonic acids, and but a very small quantity of allantoin; the action of peroxide of manganese upon uric acid resembles therefore very closely that of peroxide of lead.—*American Journal of Science, Sept.* 1867.

NOTE UPON A

METHOD OF VARYING WEIGHTS BY MINUTE QUANTITIES.

By J. A. BROUN, F.R.S.

A notice of a Gravimeter, proposed by me, appeared in the *Proceedings* of the Royal Society of Edinburgh early in 1861. The instrument, with various modifications, was forwarded to me in India about three years thereafter, and was found to have several imperfections which could have been corrected only by my own supervision of the work as it proceeded. His Highness the Rajah of Travancore has been good enough to sanction a sum of money for the construction of a second instrument, with all the precautions experience has suggested.

There are two methods by which the observations may be made. One, by which there is a constant angle of torsion of a single wire giving a variable angular movement to the weight suspended by two wires (depending on the force of gravity at the place of observation). The other, by which the weight suspended is varied, and the angles of torsion of the single wire and movement of the weight are constant. This second method I had at first rejected, as experience had shown me the difficulty of changing the weights without affecting the stability of the instrument. I desire now to note that I devised, about a year ago, and communicated to different men of science, a method of varying the weight, suspended with the greatest delicacy, and without jar to the instrument. This method consists in suspending from the weight a metallic wire, which enters a piece of barometer tube fixed below the instrument: by means of a screw entering a cistern below the tube, mercury (or another fluid) can be forced into the tube so as to immerse the metallic wire in the fluid; the wire being properly chosen as to fineness, or as to its specific gravity compared with that of the fluid, and the height of the fluid being read to a thousandth of an inch as in the barometer, the weight suspended can be made, by turning the cistern-screw, to vary gently and gradually, by as minute a quantity as we please; while the eye is occupied with the coincidences of the telescope wire and its images, which indicate the constancy of the angles of torsion of the single and double wires.

Although the difference of the specific gravities is considerable, I propose to employ iron for the wire and mercury for the fluid.

It has occurred to me that this method of varying a weight might be of use in other branches of research.—*Proceedings of the Royal Society of Edinburgh, Session* 1866-67.

NOTES ON POWDERED CASTILE SOAP.

By JOSEPH P. REMINGTON, Brooklyn, N.Y.

THE following notes are contributed to the present fund of knowledge on the subject of drug powdering:—

Exp. 1. 986 avoirdupois ounces of white Castile soap (Conti) were shaved into thin slices, by means of a common cabbage cutter, then spread on shallow trays, and exposed to the air in a drying room, temp. 84° F., for one week, transferred then to a drying room, temp. 125°, and left there three weeks, at the end of which time it weighed 724 ounces avoir., thus losing 26·57 per cent of water; it was then powdered in the ordinary chaser or Chilian mill, and lost 7 ounces more in the process of pulverising, making the total loss 27·28 per cent.

Exp. 2. 960 ounces avoirdupois of the floating variety of white Castile soap, after standing in a moderately dry room for fifteen months (losing 224 ounces, or 23·3 per cent,) on being further dried and powdered, in a similar manner, lost 56 ounces more, making a total loss of 280 ounces, or 29·16 per cent.

Exp. 3. 1,112 ounces avoirdupois of mottled Castile soap (commercial) treated precisely in the same way, lost 320 ounces, or 28·8 per cent. The average loss on five previous lots was 21 per cent, the amount of water present varying in each case, losing respectively 20, 11½, 18, 27 and 29 per cent. The lots which lost 11½ and 18 per cent had undoubtedly been kept some time, and in the case of the lot losing 11½ per cent, half of the water which would help to form the ordinary loss was lost before it was sent to powder. The first and last experiments were made with soap recently imported. It will be noticed that in these experiments (which I may state were carefully conducted) that the mottled Castile soap does not support its reputation for strength (its only credited merit over the white.) According to the U. S. Dispensatory, good mottled Castile soap should not contain more than 14 per cent of water; this contained, then, double the proper amount. The same authority states that white Castile soap should not have more than 21 per cent; in both experiments with the white; it was found to contain an excess of at least 6 per cent of water.

There is an important reason for not putting the soap in the room of higher temperature at first, for it would then melt, instead of drying properly, and become unmanageable. The powder from the first experiment was fine, light, and very white; that from the second was not so white, owing, probably, to the fact of its being kept a greater length of time and the presence of a little sesquioxide of iron, the colour of the iron being masked when the soap was fresh, as in the first experiment, the iron being then in the state of protoxide; 21 cents per lb. was paid for the white soap (in Exp. 1) which was a low figure (Feb., 1867), and as the loss was 27·28 per cent., allowing 12 cents per lb. for powdering, the lowest cost of the powder would be 38 cents, and yet a powdered white Castile can be *bought* for that price; the inference regarding the character of such a powder is of course unmistakable. It would be an easy task for the pharmacist to prepare his own powdered soap, the only necessary outlay would be for that unscientific instrument, the cabbage cutter, which, however, could be used with advantage in making tinct. sapon, camph., opodeldoc, soap plaster, &c., not to speak of its legitimate use; for small operations the soap could be shaved with a spatula. If a drying room is not at command, the difficulty of drying it thoroughly may be overcome by shaving the soap very thin, then spreading on paper and setting in a warm place; the drying of course is hastened by a current of air. After it becomes dry and friable, it can be easily powdered in a mortar and sifted through a fine sieve, and the pharmacist has then the satisfaction of saving the difference in the cost of powdering and of furthering the cause of "Medicinæ Puritas."—*American Journal of Pharmacy.*

PARIS EXHIBITION OF 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

Messrs. Hopkin and Williams, of New Cavendish Street, London, have a most remarkable display of rare and valuable chemicals. It is not too much to say that these gentlemen have, by the articles they have exhibited, shown themselves to be second to none in their profession for chemical skill. The collection of specimens illustrating the chemical history of thallium and its compounds is absolutely unrivalled, and casts into the shade every thing that has been done by the French chemists. This series of compounds is far too remarkable to be cursorily passed over; we shall, therefore, describe them *seriatim*, as briefly as is compatible with doing justice to the subject.

Metallic Thallium.—This is shown in the form of a large bar, weighing 2 lbs. It has a dull leaden colour, owing to a film of oxide. It is only necessary, however, to wash the bar in water to obtain it with a brilliant metallic lustre. The water becomes strongly alkaline, and is in fact a solution of oxide of thallium.

Oxide of Thallium.—This substance yields a colourless solution when dissolved in water, it is strongly alkaline, and precipitates solutions of nitrate of silver, &c., as if it were a solution of hydrate of potassium. On concentration of the aqueous solution of oxide of thallium, it deposits yellow crystals of the hydrate; these crystals lose water very readily, yielding the dark coloured mass of dry protoxide of thallium as exhibited. If dried *in vacuo* so as to prevent the formation of traces of peroxide the salt would be colourless.

Suboxide of Thallium.—When the metal is fused in the air a very mobile, dark coloured liquid is formed upon the surface of the melted metal; upon cooling it can be separated; it is insoluble in water, and has entirely different properties to the peroxide.

Peroxide of Thallium.—This specimen was prepared by adding a solution of hypochlorite of sodium to a boiling solution of protoxide of thallium, the peroxide is precipitated under the form of a brown powder.

Sulphate of Thallium.—A superb specimen of large and fine crystals about two pounds in weight.

Nitrate of Thallium.—A large specimen, colourless and well crystallised.

Chloride of Thallium.—About two pounds weight crystallised from twenty gallons of boiling water.

Perchloride of Thallium.—A very fine specimen produced by the action of nitric acid on a boiling solution of the chloride.

Bromide of Thallium.—This salt is less soluble than the chloride, and was consequently prepared by precipitation.

Iodide of Thallium.—Almost insoluble in cold or hot water; a cold solution of bromide is precipitated by iodide of potassium.

Periodide of Thallium.—Made by partially precipitating a boiling solution of the perchloride by iodide of potassium. The salt is dark brown, and if in the course of preparation an excess of iodide of potassium is used, it rapidly becomes converted into ordinary iodide.

Silicate of Thallium.—Prepared by decomposing a solution of nitrate of thallium with silicate of sodium; the solution is boiled, and on cooling deposits the silicate in crystals.

Phosphate of Thallium.—Produced in the same manner as the silicate, substituting phosphate for silicate of sodium. The phosphates of thallium require investigation.

The molybdate, vanadiate, sulphantimoniate, sulphocyanide, cyanide, benzoate, oxalate, borate, chromate, bichromate, are also exhibited, but do not call for any special remarks.

Sulphide of Thallium.—This compound may be produced by fusing thallium and sulphur together. Sulphide of hydrogen does not precipitate the solutions of the sulphate, nitrate, &c., but an abundant precipitate is produced in the solution of the acetate, and as thus prepared it can be washed and dried, but if precipitated by sulphide of ammonium, and the precipitate be washed, &c., when approaching dryness it will take fire even at a very moderate temperature. In fact, Messrs. Hopkin and Williams informed your correspondent that they could not succeed in preparing a permanent sulphide of thallium by this process.

Carbonate of thalium, upwards of 1lb in weight, and in good and white crystals, is also an interesting salt.

There were also exhibited the acetate, chlorate, bitartrate, and tungstate of thallium. Among the double salts we observed thallium alum, platino-chloride, sodio-tartrate, and the tartrate of thallium and antimony (thallium tartar emetic).

It would be impossible to estimate too highly the skill, perseverance, and chemical knowledge shown by this

firm in the preparation of the extraordinary and unrivalled collection of preparations of thallium contained in their case.

In addition to the above there is an admirable collection of fine chemicals, not mere showy crystalline salts, but preparations requiring far more than the average amount of scientific information for their production. The bottle of cantharidin contains nearly 5 ounces of superb white crystals of this substance. The specimen is the finest of its kind in the Exhibition, and is decidedly better than that in the case of M. Menier, although the latter is very good. It would be improper to pass over without notice the bromides of potassium and ammonium, and the iodide of ammonium.

The specimen of pyrogallic acid has evidently met with an accident, and been subsequently put into a dirty bottle; this is unfortunate, as this firm for many years were by far the largest makers of it.

The crude oxalate of cerium which, is still used as a remedy in cases of obstinate vomiting, does not call for any very special remark. The same applies to the permanganate and cyanide of potassium.

The glacial phosphoric acid is very fine and pure. Large quantities of this substance are shown in the German department, and sometimes in sticks. In the latter state it has a very pretty appearance, but the German acid found in commerce is generally far from pure, containing soda, and almost invariably more than traces of lime and ammonia. Your correspondent is informed by Messrs. Hopkin and Williams that the syrupy phosphoric acid yielded by the action of nitric acid on phosphorus will never yield a solid brittle phosphoric acid by direct heating; no matter how elevated the temperature to which it is subjected, the product always remaining is a soft adhesive mass, and, at an elevated temperature, either partially sublimes, or, at all events, yields a volatile product.

The scale preparations of iron—for example, the ammonio-citrate, the ammonio-tartrate, the potassio-tartrate, and the citrate of iron and quinine—look very well, especially when their long exposure to light and heat is considered. These articles, although invented in France, have become enormously used in England, and are made upon a very large scale by several manufacturing chemists. The price in England is three or four hundred per cent cheaper than in France or Germany. The scale preparations in Messrs. Hopkin and Williams' case have certainly kept better than any others we observed, excepting, perhaps, the ammonio-citrate of bismuth which has turned black.

Taking it all together, we consider that Messrs. Hopkin and Williams' case is in the very highest degree creditable to them. It is quite evident that they do not allow themselves to fall behind any of their contemporaries; and considering the efforts that our chemical manufacturers are obliged to make to compete with the skilled labour and low wages which are such immense helps to their German rivals, this is saying a great deal.

We are glad to find that they have been awarded a silver medal.

Mock Scotch Soda Crystals.—These are properly sulphate of soda. It is, however, difficult to tell them from Scotch soda (washing soda of the shops) by the eye alone. They are prepared in the following manner:—A quantity of the ordinary "salt cake" is dissolved in a pan to 40 or 45° Twaddell; the liquor, if it shows acid, is neutralised with milk of lime, and 12 lbs of soda ash to every 100 lbs of the sulphate of soda is added in solution. The liquid is allowed to settle and then drawn off into coolers to crystallize. The resulting crystals are large and hard; they are dried in the air for a short time, and then packed in casks. To make the crystals larger and more firm a greater quantity of soda ash is used. One ton of roasted cake will make about 40 cwt. of these crystals. They are vere frequently sold for the best Scotch soda.—*J. H. Swindells.*

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, Oct. 29, 1867.

Animal Miasma—Spectrum of the Bessemer Flame—Meteoric falls in Greece—Silurian System of Bohemia.

Dr. J. Lemaire continues his researches on the nature of miasma exhaled by the body of a healthy man. He finds that it is on the periphery of the body and outside the organs on which develope the microphites and the microzoaires on a man in good health. The deposit, vulgarly termed "dirt" or "scurf," that the perspiration, mingled with atmospheric and other dust contained in the linen produce on the skin, and which accumulates every day, if the body be neglected, gives rise to myriads of microphytes and microzoaires. They are the more numerous according as the deposit is more abundant. This coating contains an albuminoid matter capable of coagulation, furnished by the perspiration, which also maintains it in a humid state.

The contact of the air and the mean temperature of the neighbouring body, about 37° C., are the cause that this crust is in the most favourable condition for fermentation to take place, and the infusoria to be disengaged and developed. In studying the effects on men and women from 30 to 70 years, whose cleanliness had been neglected for a week or two, there were remarked a fetid odour in various parts of the body, and a slightly acid liquid containing transparent spherical ovoidal and cylindrical bodies similar to those found in the confined air of the Eastern fort; thousands of bacteria (*Bacterium termo*, *Bacterium catenulæ* formed of 2, 3, 4 and 5 articulations, *Bacterium punctum*), vibrios, &c.

In the former experiments the presence of entirely developed animalculæ six hours after the condensation of the aqueous vapour of the barrack-ward, can be explained by the elevated temperature of the human body and the existence of a great quantity of vapour in this air. They are no doubt furnished by the elevated temperature of the climate and the animal heat in adults, which produce miasma so fatal in tropical climates to man and beast.

Professor A. Lielegg has continued his researches on the spectra of the flame in which the melting is carried on according to the Bessemer system. This flame being only carbonic acid gas in an incandescent state, and the spectrum of this gas being yet unknown, the observations of M. Lielegg have served to fill up a gap in the series of spectra produced by the gases in combustion. The apparition and the disappearance of some of the luminous fixed lines is closely connected with the metallurgical operations. At the moment when the decarburisation of the iron is nearly terminated, these spectral lines assume essential modifications. The apparition of a group of lines and of an isolated line in the violet-blue portion of the spectrum, marks a particular movement of the period during which the soft iron is being formed, and these lines disappear sooner than all the others; their appearance and disappearance serve, therefore, to indicate the termination of the process.

In a letter addressed to M. Haidinger, M. Jules Schmidt gives some notes upon some igneous meteors observed in Greece. The meteoric fall of Nauplia was observed the 17-19 June, 1850, about ten o'clock at night, by M. A. R. Logothetis. In a perfectly clear sky, the meteor, like a swarm of falling stars, seemed to travel from East to West, and fell at the North of Nauplia near Tyrinthia. Shortly after its appearance a loud explosion like thunder was heard. The search made on the following day gave no trace of meteoric substances. It was only subsequently that a fragment of black stone was brought to M. Logothetis. This fragment, lost by carelessness, was about twice the size of an egg, and had the aspect of a metallic substance subjected to the action

of fire, presenting here and there reddish golden specks. It evidently contained metallic iron and sulphur. A meteor of the first magnitude was observed at Athens on May, 1857, at 11h. 46m., at 20° N.W. of the zenith having its radiating-point situated between Scorpio and Sagittarius. It was bright green, with a beautiful red trail. A sudden explosion accompanied the traject, which only lasted a second. An explosion similar to that of a heavy cannon was heard about a mile and a half fifty-three minutes after its extinction. The conclusion is, that the detonation took place fourteen geographic miles from Athens, at the height of about thirteen miles above the plain of Thebes. A similar meteor but much smaller was observed the 16th May, 1862, at 8h. 24m. The catalogue of M. Schmidt states the occurrence, for the 17th May, of eleven great meteors, four of which were terminated by showers of stones; on the 26th May, date of the fall of the meteoric stone of Agram (1751), seven meteors, two of which were accompanied by showers of stones, and one by the fall of meteoric iron. An enormous one passed over Greece on the 27th May, 1867, at 2½ to 3h. in the morning.

M. J. Barrande published in July a new continuation of his magnificent work on the Silurian system of the centre of Bohemia, a volume in 4to, containing 179 pages and 16 plates, treating on Pteropode mollusca (69 species, included in 8 genera) the remains of which are included in this formation and others, such as Columates, Trochocystites, Chittons, and Rhombifera. F. Moigno.

PROCEEDINGS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

On some Experiments of Faraday, Biot and Savart, by John Tyndall, Esq., L.LD., F.R.S., Professor of Natural Philosophy, R.I.

The discourse was delivered at the request of the excellent President of the Royal Institution. The speaker had no new discovery to make known, and the utmost he could hope to achieve was to give a few old discoveries in such a form as would interest an intellectual audience.

A few of the more striking phenomena of electro-magnetism were first exhibited by means of a helix and a core of soft iron. The question arose, "suppose that core to be transparent, what would be the effect of its magnetisation upon a beam of light passing through it?" Probably such a question presented itself to the mind of Faraday. But iron was not transparent, and our great experimentalist had to seek long before he found a transparent substance, which enabled him to demonstrate the action of magnetism upon light.

Light in its natural condition was not sensibly affected by magnetism. The speaker then defined and illustrated, by means of a Foucalt's prism and a plate of tourmaline, the action of "plane polarized light." He then showed the chromatic phenomena produced when a plate of rock-crystal, cut at right angles to the axis, was placed between the polarizer and analyzer of a polariscope. He also defined and illustrated, by means of the tourmaline, what was meant by the plane of vibration and the plane of polarization.

A plate of quartz, composed of two semicircles, the one belonging to a right-handed and the other to a left-handed crystal, was placed in front of the electric lamp, and through the plate was sent a beam of plane polarized light. The beam then passed through two perforated masses of iron, which rested on the two ends of a powerful electro-magnet—these pieces of iron were in fact the movable poles of the magnet. Beyond the furthest pole was placed a Foucault's prism, through which the beam also passed, being finally received upon a white screen. A lens was introduced between the circular plate of quartz and the magnet; and by this lens a magnified image of the plate of quartz was thrown upon the screen.

The speaker showed the changes of colour produced when the plane of polarization was caused to rotate. Bringing, for example, the entire image of the quartz plate to a delicate puce, the slightest rotation of the Foucault's prism coloured one of the semicircles a vivid red and the other a vivid green. Restoring the puce colour, and placing a bar of the heavy glass with which Faraday first demonstrated the action of magnetism upon light from pole to pole of the magnet, the beam was transmitted by the glass, and the image upon the screen was unchanged.

On now exciting the magnet, the uniformity of the colour disappeared; one semicircle ran rapidly into a vivid red, the other into a vivid green. The relative position of the colours changed when the direction of the current was changed: when the current was interrupted, the puce colour was restored. Thus it was proved that the act of magnetization produced the same effect as the mechanical rotation of the plane of polarization; and this is the celebrated experiment which Faraday described as the magnetization of a ray of light.

The beautiful experiment of Biot on the influence of sonorous vibrations on plane polarized light was next thrown into a form which allowed the whole audience to see the effect. A rectangle of glass, 6 feet long, 2 inches wide, and about ¼ of an inch thick, was clasped by a clamp at its centre, being so placed between the polarizer and analyzer that the beam crossed the glass rectangle near its centre. The polarizing prisms were placed so as to darken the field of view. A sweep of a wet cloth over the distant half of the glass rectangle brought out its tone, and immediately a luminous disc a yard in diameter flashed out upon the screen. Every sweep of the cloth threw the glass into sonorous vibration and illuminated the screen.

A plate of selenite was so placed between the polarizer and analyzer as to show a system of vividly coloured rings. By a suitable arrangement of the experiment, the colours were wholly obliterated when the glass rectangle was thrown into longitudinal vibration.

None of these effects could be produced when the polarized beam passed through the rectangle near one of its ends; for here, as is well known, the necessary strains and pressures were absent.

The remaining experiments had reference to the action of sonorous vibrations upon jets of water. A vein was discharged obliquely from the nipple of an ordinary gas burner. The vein broke into scattered drops. By the light of the electric lamp, a dense shadow of the vein was thrown upon a white screen; on sounding an organ pipe, or a tuning-fork of the proper pitch, the drops suddenly gathered themselves together, forming an apparently continuous band several feet in length. On the suspension of the sound the drops broke asunder as before. The minuteness of the vibration, which is competent to produce this effect upon the vein, is extraordinary. After a tuning-fork had ceased to be heard, when placed against the support of the nipple from which the vein issued, the drops gathered themselves together, and remained in coalescence long subsequent to the apparent subsidence of the motion.

A jet of water was permitted to descend vertically. Its two portions, the continuous and the discontinuous, were described. An arrangement was devised by which the vein was vividly illuminated from above. The continuous portion was of dazzling brilliancy; the point of rupture being thus rendered strikingly manifest. On sounding the proper note, the continuous vein shrunk almost up to its aperture. The effect of beats was very fine; as they addressed the ear, the lengthening and shortening of the luminous cylinder, in perfect synchronism with the beats, went on. Here also the amount of motion, if only of the proper quality, which influences the vein, may be infinitesimal; the vein, in fact, declares the existence of the beats long after the ear has ceased to hear them.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, October 15th, 1867.

J. P. Joule, LL.D., F.R.S., &c., Vice-President, in the Chair.

"*Note on the Occurrence of Sulphocyanide of Ammonium in Gas Mains*," by Peter Hart, Esq.

A few months ago while some gas mains in the street were being replaced, I was induced to examine the scale which forms in the interior, being under the impression that probably I should find sulphide of iron the result of long-continued action of sulphide of hydrogen on the iron. On placing a portion of this scale in pure hydrochloric acid I perceived an intense reddening, much more than would be accounted for by the simple solution of peroxide of iron, and being aware of the fact of sulphocyanogen being one of the products of the distillation of coal, I at once suspected its presence. A portion of these scales was boiled in water. The clear filtrate from this gave off much ammonia on the addition of alkali, and on the addition of a dilute solution of perchloride of iron it gave at once the intense colouration so characteristic of the sulphocyanides. The insoluble portion remaining on the filter was then boiled in dilute caustic soda; the filtrate from this made acid, and a solution of ferric oxide again added, this time with the production of a blue precipitate indicative of a ferrocyanide. This must have existed as ferrocyanide of iron, which on boiling with the alkali became oxide of iron and ferrocyanide of sodium. There appears to me something curious in the fact of these bodies being carried such a distance (in this case fully a mile from the gas works) by the gaseous current. I should think the ferrocyanogen is the result of a reaction between the sulphocyanogen and the metallic or oxide of iron. The amount of these bodies must, I think, be far too small to have any bad effect on the health of gas consumers.

"*Jupiter as observed at Ardwick on the night of August 21st, 1867*," by J. B. Dancer, F.R.A.S.

The somewhat rare phenomenon of Jupiter without a visible satellite extraneous to his disc (as the Rev. W. R. Dawes has correctly designated it) has been described in the *Astronomical Register*. I am not aware, however, that any notice of it has appeared before this Society, and as few observers appear to have enjoyed such favourable atmospherical conditions as we did in this locality, I am induced to offer a few remarks on the appearance which Jupiter presented on the night of August the 21st.

During the early part of the evening the S. and S.E. portions of the heavens were covered with thick haze; between 8 and 9 o'clock this gradually disappeared, and the atmosphere became clear and unusually favourable for astronomical observations. Preparations had been made for noting the times of the phenomena, but from various circumstances this was abandoned. The observations were made with an achromatic telescope of 7¼ feet focus and 6¼ inches clear aperture. Powers employed, 90, 175, and 300. At 9 o'clock Jupiter was clearly defined and presented a remarkable appearance. On the broad south belt three spots were distinctly visible, and at the same time three satelities appeared off the disc. The first spot in the order of transit was very black—this was the shadow of the third satellite. The next spot was brown in colour when contrasted with the belt—this was the third satellite; and the third spot, which was the shadow of the fourth satellite, was very dark and well defined. At this time the fourth satellite appeared very faint in comparison with the first satellite, which was just below it. The second satellite, which was on the west edge of the planet, was soon eclipsed, and attention was entirely directed to the fourth satellite, which was the next to transit. As this satellite entered on the disc it was visibly brighter than the planet; after a short time it disappeared, and then, to my surprise, it became visible again as a dark spot, and at intervals it was as black as its own shadow. The alteration in the colour of this satellite during its transit has been noticed by several observers, but I was not prepared for such a complete change from a bright object to one as black almost at times as an ink spot. During these observations the first satellite had entered on the disc of the planet, and when it was about half its diameter on the planet it appeared to me to be in contact with its own shadow. After a short time I could only distinguish the first satellite at intervals, closely following its own shadow. Before the third satellite passed off the disc it became nearly invisible, and when close to the edge of the disc it appeared brighter than the surface of the planet. The fourth satellite was not observed at the end of its transit.

Mr. Robert Worthington, F.R.A.S., observed some of the phenomena with me, and remarked at the time that he did not recollect having seen Jupiter so sharply defined as on that evening. The bays and various markings on the belts were most beautifully distinct.

"*Notes on some Superficial Deposits at Great Orme's Head, and the Period of its Elevation*," by R. D. Darbishire, B.A., F.G.S.

MICROSCOPICAL AND NATURAL HISTORY SECTION.

October 7th, 1867.

J. B. Dancer, F.R.A.S., President of the Section, in the Chair.

The President, in his address to the members of the Section, described the various additions and improvements which had taken place in microscopes and apparatus, and gave a summary of the microscopical researches which had been communicated to various societies, both English and Foreign, during the past year.

The following extract of a letter dated 27th of August, 1867, from Captain Mitchell of Madras, was read:—

One or two things have come under my notice, which a friend who arrived in Madras from London a short time since, said he believed were unknown to microscopists in England, I therefore send you a brief notice of them, in the hope they may interest some of the members of the Society.

The first is the presence of ciliated infusoria in dewdrops on leaves. I have to confess I took the subject up in jest, in consequence of a remark in an article published in one of our local papers; about sunrise I placed an animalcule cage under the point of a leaf and transferred the drop of dew gathered there to the glass plate, and then examined it with the microscope. I repeated the experiment on two other occasions, and the result was, that in about one drop out of every two I found one, and sometimes two infusoria.

As the dew did not begin to fall until midnight, they must have been produced from the germ between that time and 6 a.m.

On the first occasion I saw also what I took to be one or two spores of fungi. I supplied the cage with distilled water and put it by until the next morning, when I found a perfect forest which continued to multiply so long as I supplied it with distilled water, which I did for several days. It will be interesting to ascertain if infusoria are found under similar conditions in England.

Some time ago Mr. Ross sent me a binocular body for my stand (one of his father's make). I have in my cabinet the tongues (so called) of two house flies, which I had mounted some years back. I was always under the impression that the divided absorbent tubes were enclosed between the two membranes that form the upper and lower surface of the two lobes, and I believe that is the general opinion of their structure; now on placing one of these specimens under a half-inch glass with the binocular body.

I was not a little astonished to see the tubes standing out above the surface of the membrane on the lower or under part of the tongue.

I was always at a loss to understand the use of these very curious vessels, but it now seems evident that fluids may be taken up by them and conveyed to the larger central tube into which they all run. It is I presume known that these tubes all open on the upper surface of the lobes by the other and narrower extremity.

Mr. Latham read the following communication on Silk-producing worms from Natal :—

In the *Natal Herald* of the 8th August last, there are copies of a correspondence between the Chamber of Commerce of this place and some gentlemen at Natal regarding certain silk-producing worms, as they are termed, found near Graham's Town by Mr. Hillier, feeding on the leaves of the mimosa thorn or acacia.

The result of the correspondence was, that some of the cocoons were presented to the Chamber here to have them reported on and their true value ascertained.

They came into my hands, and the following remarks on them may be interesting to the Society :—

From one of the cocoons the moth now exhibited emerged shortly after its arrival in England, and though much crippled, I have, through the kindness of Mr. Jansen, had it clearly identified with the insect "Pachypasa effusa," of which there are several specimens in the British Museum collection from Natal.

The moth laid about 50 eggs, of which I have mounted two or three, and they are here for examination.

The eggs under the microscope exactly resemble in texture those of the ostrich, but each has a small black point, probably of a softer substance than the rest of the egg, and through which the caterpillar may emerge.

From one of the cocoons I extracted the chrysalis also exhibited, and further the cast skin of the caterpilar rolled into a small ball as usual ; by boiling this for some time in caustic potash, it became so softened that it was possible to get it to its original size, and to show its original form. You have it before you dried, and the series is therefore complete, egg, caterpillar, chrysalis, moth, and cocoon.

The original cocoon is, you will notice, a hard woody-like substance, but by certain processes, Mr. Hillier states soaking in a solution of soda, the cement agglutinating the silk is dissolved and a soft silky-looking bag remains.

This consists of a thick outer covering, a loose middle lining, and a thinner internal lining, all of silk, which I hardly think could be wound but might possibly be carded.

As regards the commercial value of the article, an eminent silk broker writes as follows :—

"It is a carded cocoon, the waste silk is the outer covering of the cocoon and appears of tolerable fine fibre, but is bad in colour and not of a good merchantable appearance, if in quantity worth perhaps 1s. 6d. per lb. all round.

"Enquiries of a similar nature have been made from time to time by customers in the East, where silk does not form one of the staples of the country, and among other places, from Natal, but we do not find that any good can arise from efforts made to produce silk in any quantity ; it is probably the most difficult of all known staples to establish in a new land."

ACADEMY OF SCIENCES.

October 21, 1867.

(From our own Correspondent.)

The Newton-Pascal Forgeries—Volcanic Phenomena - Discovery of the Law of Gravitation—Theory of Solar Spots—Determining the Longitude—Formation of Crystals of Gypsum.

Sir David Brewster addressed to M. Chevreul, in terms of great friendship, a new letter against the authenticity of the autographs of M. Chasles, which he calls the most audacious imposition of modern times. This attack of our illustrious and venerable friend gives us great pain, and the more so as it is reduced to a series of assertions immediately confuted by incontestable facts.

1. "King James II. could not have written to Newton from Saint Germain on the 16th January 1688, as he only arrived at the end of 1688." In the *Comptes Rendes* of the Academy, p. 551, the date of 1685 is evidently an error, as the second letter, posterior to that of 12 January, 1689, could have been no other than that of the 16 January, 1889.

2. "How could James II. have written to Newton, whom he knew to be an anti-Jacobite, and one of the conspirers to upset the throne ?" In the letters of M. Chasles we read, in fact, that Newton was very embarrassed to have to answer King James ; that the King reassured him, saying that in repelling him from the throne he only did his duty.

3. "Newton could not have accused Flamsteed of the disagreements which called forth the injurious words against Descartes and Pascal inserted in the letter to Huyghens, since at that period Newton and Flamsteed were friends." All the correspondence known of this period, manuscript or printed, shows that Flamsteed always complained of Newton's treatment towards him.

4. "Who can believe that Louis XIV. would have occupied himself with an incident so insignificant as two two or three disdainful words uttered against Descartes and Pascal ?" Authentic autographs of Louis XIV. prove, as Sir David could have seen by the note of General Morin, that the great king occupied himself with the change of garrison of a detachment of 25 to 30 men. Louis XIV. was also much occupied with the injury done, by Newton, to our two illustrious countrymen. There are mixed up in this affair not only James II. and the Abbé Bignon, but Huyghens and the celebrated astronomer Bouillaud, whom he made his confidential adviser in matters relating to science and savants, by whose medium he negotiated the recall into France of Huyghens and Cassini. M. Chasles has in his hands the letters by which Louis XIV. asks Bouillaud to make a report on Newton's affair, invites Huyghens to return to Paris to give explanations on this subject, and excuses himself towards James II. for the susceptibility he had manifested on this occasion in indicating the duties of a sovereign towards his most illustrious subjects. Thus, we see, the assertions of Sir David Brewster are promptly refuted ; the timid and embarrassed style of Newton's letter to the King of France is revolting to him. M. Chasles besides the rough copy of the letter of Newton, possesses the answer to Newton on which we see the words "*Vu bon*" in the well known handwriting of Louis XIV. Evidently the ground is no longer tenable by the adversaries of the authenticity of the autographs of M. Chasles. Exery objection raised against it becomes an argument in its favour. M. Chasles has indicated, without been obliged to do so, the source of these documents,—the cabinet of Desmaizeaux ; it is now known that they were purchased by the Chevalier Blondeau de Charnage ; that two English gentlemen, Messrs. T. Winthrop and W. Robertson, wished to purchase them for 40,000 francs. It is even impossible that there does not remain among the papers of Newton's family in the possession of the Earl of Portsmouth and the Earl of Macclesford, traces of this negotiation and of the relations between Pascal and Newton. We know also the greatest number of the portfolios from the cabinet of Desmaizeaux are in London, probably at the British Museum, since Desmaizeaux died in London ; it is necessary to find them, and thus furnish evident proofs of the absolute authenticity of the treasure of M. Chasles.

M. Fouqué, charged with studying in a chemical point of view the phenomena of the volcanic irruption of the Azores, which took place at the beginning of last June, writes that he has succeeded, not without great trouble, in collecting enough gas, rising from the bottom of the sea, to make the analysis, and to ascertain that it is entirely free from carbonic acid, and rich in oxygen.

M. Babinet fixes the year 1670 as the epoch of the definitive discovery, by Newton, of the laws of universal gravitation. It was only then that he finished the calculation of the fall of the moon upon the earth. At the moment when he foresaw the result of his calculations conformable to his previsions, he was obliged through illness to get them finished by a friend.

M. Kirchhoff and M. Faye agree upon the theory of solar spots, which the latter attributed to an opening in the solar photosphere, allowing the kernel to be seen, the emitting power of which is inferior. M. Faye continues to deny the possibility of the transmission of light through the nucleus.

M. Faye announced that the new method of determining the longitude by M. Littrow, has given the best results.

M. Dronke, professor of Chemistry at Coblentz, read a note on the gradual formation in a mass of clay of crystals of gypsum, some of which were 14 centimètres long.

F. MOIGNO.

QUEKETT MICROSCOPICAL CLUB.

THE monthly meeting of this Club was held at University College on Friday evening last, Oct. 25. (Mr. Arthur E. Durham, President, in the chair).

Mr. S. J. Mc INTIRE read a paper on "*Chelifers*," in which he gave some interesting facts with regard to the haunts, habits, and mode of capture of these curious animals, resembling minute scorpions and having the backward and sideway motions of crabs. Of the 54 known species 8 are British, and are chiefly found under the bark of trees, and in houses amongst old papers, &c., often rendering good service by feeding on the insects which are usually so destructive in old libraries. Several living specimens were exhibited under the microscopes, where their activity in the pursuit of their prey was conspicuous.

A paper by Mr. C. NICOLSON, M.A., "*On Object Glasses for the Microscope*," was read.

Nine members were elected.

THE WATER SUPPLY OF CALCUTTA.*

THE question of the water supply is now being agitated in Calcutta, and the first of these papers has been drawn up by Mr. Spencer, by order of the municipal justices.

The matter treated of in the report is taken under the following heads—subsidence, mechanical filtration, purification, nature of the purifying material. The Hoogly water it appears contains a large quantity of suspended matter, the greater part of which is very fine mud. The author thinks it would not be safe to estimate the amount of sedimentary matter at less than a cubic inch to a cubic foot of water. He therefore strongly insists upon the necessity of large reservoirs for the subsidence to take place in, so as to give the filter beds as little mechanical work as possible. There are some differences from the ordinary methods, and apparently advantages in the one recommended for the construction of the filter beds.

The water enters the beds considerably like a spring. It is supplied from a basin in the centre, and spreads gradually over the surface. The author says: "The water descends through the sand, not in straight, but in a series of conoidal lines, intersecting each other, and which converge below at the regulating apparatus, where the water is bent upwards, as in a spring, before it reaches the lateral drains at the bottom of the bed." The purifying material is magnetic oxide of iron impregnated with carbon; it is mixed with sand, and fragments of some coarser material are added to act as retarding media.

It is necessary that the magnetic oxide should be porous, and for this reason the native mineral is not suitable. The author explains that a compact crystalline ore cannot be as effective as the same material when porous; few would be inclined to dispute the fact. In the preparation of the artificial magnetic oxide to be used, either spathic iron ore, or hæmatite is heated until the carbonic acid or oxygen is expelled. The heat required in the latter case must make it a rather expensive operation. The porous material remaining is impregnated with carbon.

The use of this purifying material, to which the name carbide has been given, is to destroy the organic matter in the water. The ordinary process of atmospheric oxidation proceeds more rapidly, we are told, by a magnetic attraction for oxygen, which the carbide possesses.

"The purifying operation which takes place in contact with the carbide, may be explained by stating, that the atmospheric oxygen in the water, is attracted into the pores or cells of this substance, in virtue of its magnetic nature—and because oxygen itself is also a magnetic body. The consequence is, that this purifying gas, like all other magnetic bodies, becomes polarised in the presence of a similar body, by which a complete change of property ensues. In a word, from a state of comparative inertnesss, which does not allow it to combine very readily with organic matter, this gaseous body suddenly becomes a most active agent of natural purification, viz., ozone."

The author's theory is ingenious, but like many beautiful things it is, we are afraid, fragile.

It is mentioned in the report that large purifying works have been constructed at Wakefield in Yorkshire, upon the plan recommended, and have proved very successful. Still it is a curious fact that so little has been heard of this process during the seven years in which the author says he has had practical experience with it. In remarking this we have no wish to disparage Mr. Spencer's process: on the contrary, if the purifying material possess the virtues accorded to it by the discoverer, it is especially our duty to protest against anything less than the universal application of the process in this country. The destruction of the organic matter contained in water used for drinking purposes is a question of immense importance. Unfortunately results obtained with any method by its discoverer, are apt to be viewed sceptically. There are many who believe such bodies as carbon, and magnetic oxide of iron, to act by the oxygen which has been condensed in their pores when dry, and that after being in contact with water for a time, the action becomes feebler, and finally disappears. We are not aware that any experiments proving the contrary in the case of the magnetic oxide of iron have ever been published if made. The subject is too important to allow of the passing over of facts, as if proved, without such has been shown to be the case by the most rigid tests. A few lines further on a quotation is inserted, containing an assumption which it is hardly possible to grant.

An examination of the Hoogly water suggested to the author the presence of decomposing animal matter in the water. Describing the odour emitted, he says:—"It was that peculiar odour which unmistakeably betokens those gases which are generated by decomposing animal matters." Shortly afterwards this statement occurs, in reference to the water passed through a carbide filter. "Subsequent analysis showed that it contained (0·60) a very little over half a grain of organic matter to the gallon—a quantity which is practically harmless, if composed of vegetable matter." Has the author any reason

* "Report on the Purification of the Hoogly Water for the Supply of Calcutta," by Thomas Spencer, F.C.S.

"Experimental Investigations connected with the Supply of Water from the Hoogly to Calcutta," by David Waldie F.C.S.

to suppose that the decomposing animal matter would be oxidised before the vegetable matter? Most chemists would oppose such a supposition, but the author makes use of it as a *quasi* fact.

The amount of organic matter in the water of the River Hoogly, after separation of sedimentary matter, is given, as well as that of the other constituents, in an addendum: organic matter and loss together equal 1·96 grains to a gallon. This amount includes certain small amounts of phosphoric and nitric acids, which were detected, but were too small to bear quantitative estimation. In the present scheme there would be 8 filter beds, and 5,000 tons of carbide is the amount estimated as necessary for the proper purification of the water which would pass through.

Mr. Waldie has been engaged for some time in making a minute examination of the constituents of both the water and mud of the Hoogly, believing the research would possess some scientific interest. The investigation, he says, is far from completion, but as the subject is now attracting considerable attention in Calcutta, he publishes some of the results obtained—those bearing on the suitability of the river as a source of water supply for domestic purposes. This water has been found to be superior to most of the other waters supplied to the town. These other waters are the tank waters, which the author found to be harder, and to contain much more organic matter—two, three, or four times as much. The Hoogly water is rather hard during the dry season, but by boiling the hardness is reduced to a very small amount. As regards organic matter, the river water is better than any of the London waters. In January and November it in no case exceeded 1·05 grains per gallon. During flood tide the organic matter is about twice as much as during ebb tides. Yet the highest amount obtained was rather less than two grains per gallon. The quality of the organic matter does not seem very satisfactory. The author says that when partially separated from saline matter, the organic matter in the Hoogly water, during the rainy season, resembled in its general properties, animal excrementitious matter; while in the dry season it more resembled urinous secretions. Certainly, water contaminated in this way must be very efficiently purified to make drinking it a harmless experiment. The soil of Calcutta is more or less penetrated by sewage water, all over the town; for the author found that the water from temporary wells, dug for the purpose, was "simply sewage water deprived of the greater part of its bad smell by passing through the earth."

Mr. Waldie considers the permanganate of potash a doubtful means of estimating the organic matter in water; the oxidation test appears to indicate only certain kinds of impurities. According to this test General's tank-water (considered the best for drinking in Calcutta) contained as much organic impurity as the water of the salt marsh to the east of the town. The water of the circular canal, too, which receives the greater portion of the sewage of Calcutta, required no more oxygen than that of the best tanks. He believes the determination by weight to be the most trustworthy method. In summing up, the author says—As regards the inorganic constituents, the water of the Hoogly is at least as good as any supplied to London. The organic impurity seems to be worst during the rainy season; the water is purest in this respect in the cold season, and it is doubtful whether during the very hot season the organic matter equals that during the rainy season.

The Atmosphere of the Underground Railway.—On Wednesday Dr. Lankester, held the adjourned inquest relative to the death of a young woman who died at King's Cross Station. Scientific evidence was given as to the quality of the atmosphere in the tunnels by Professor J. E. D. Rodgers and Dr. Letheby. A special report has been prepared for this journal and will appear in our next.

CORRESPONDENCE.

THE CAMPHOR STORM GLASS.

To the Editor of the Chemical News.

Sir,—I see by your Notices to Correspondents that you sometimes have to answer inquiries respecting the storm glass and its value as a meteorological instrument. The frequent reference made to it by the late Admiral FitzRoy gave an almost official sanction to its use, and induced some instrument makers to manufacture it largely, and even to attach it to the ordinary barometer and thermometer. This led me to examine the storm glass with some care. I made one on a large scale, in a quart bottle, placed it on the window ledge, and kept a journal of its behaviour during some months. The conclusion I arrived at was that the storm glass is not acted on by light, or atmospheric electricity, or wind or rain, &c., but solely by variations in temperature; that it is, in fact, a rude kind of thermoscope, vastly inferior to an ordinary thermometer, and has no meteorological value whatever.

My paper on the subject is printed in the *Philosophical Magazine* for August, 1863. It produced a few remonstrances to the effect that I had degraded a pleasing instrument to the level of a toy. I believe it to be, as you replied to your correspondent, only a toy, but it is a very pretty one, and exhibits effects of crystallisation of great beauty and variety. I generally have one hanging up in a back window, and it affords me pleasure to look at it and to show it to my friends.

One of my conclusions, viz., that light has no action on the storm glass, was questioned by a gentleman with apparently so much reason and good sense that I gladly examined the case as put by him.

This gentlemen had a storm glass hanging up in a west window of a house in a street in London. He was in the habit of observing it every day during a few years. He went to reside in the country, and hung up his favourite storm glass again in a west window. He soon noticed that the crystals were larger and finer than any he had ever seen in the tube when it was in town. He naturally referred the change to the increased light and brilliancy of the sky, as compared with the dingy atmosphere of London. On inquiry I found the change to be really due to heat and not to light. In the town house the sun disappeared some time before sunset behind the opposite houses. In the country house, the west window was in full view of sunset. Now, as soon as the sun came round to the window in the afternoon of every warm, cloudless day, it melted the solid contents of the storm glass, and allowed impurities to subside; but after sunset crystallisation again took place, excluding other impurities, so that these repeated fusions and recrystallisations produced the fine crystals, and not the improved light. Such at least is my explanation of this fact as stated.

I also proved some years ago that the motion of camphor and other volatile bodies towards the light, is really towards the coldest part of the bottle. The coldest part is generally towards the light, because on that side of the bottle radiation is most free. A gentleman wrote to me that my theory could not be true, because in a number of his bottles the deposits were on the sides farthest from the light. On inquiry it turned out that his shelves were erected against an outer wall, facing the north, so that the sides of the bottles nearest the wall were constantly the coldest.

By dipping a piece of filtering paper into ether, and placing it on a bottle containing a little camphor, &c., a deposit may be determined in a few seconds to any part of the bottle at pleasure, and of any pattern or device we may choose to give to the filtering paper,—I am, &c. C. Tomlinson.

King's College, W.C., Oct. 26, 1867.

VOLATILITY OF SESQUICHLORIDE OF IRON.

To the Editor of the Chemical News.

Sir,—Since writing the letter which you kindly inserted in your last issue, the subject of it has received fuller investigation at my hands, and the views therein contained are strengthened by the following experments I have made :—

(1). Another sample of the best sulphocyanide of potassium, obtained from large operative chemists, tested with pure hydrochloric acid, gave a distinct pink tint. This sulphocyanide of potassium was dissolved in hot absolute alcohol, the solution filtered, cooled, and the crystals separated ; they were then freed from alcohol by heat. An aqueous solution was made from the salt thus obtained and filtered.

(2). The aqueous solution tested with the pure hydrochloric acid used above, gave no tint.

(3). Mr. Skey's experiment was tried with this pure reagent solution. The sesquichloride of iron and hydrochloric acid were placed in a large watch-glass having ground edges, covered with a glass plate wetted on the under side with the sulphocyanide solution. After the lapse of several minutes, the cover was removed, placed upon white enamelled glass, and more of the test solution added. The experiment was repeated several times under varying conditions ; with regard to the proportions of sesquichloride of iron and hydrochloric acid, in no case was any colouration produced in the sulphocyanide of potassium. Mr. Skey, who is evidently a diligent worker in science, has apparently misinterpreted the effect produced in a colourless solution of ordinary sulphocyanide of potassium by the vapour of hydrochloric acid.

In conclusion, Sir, I deny that at present we have any proof of the volatility of sesquichloride of iron at common temperatures.—I am, &c.,

Henry Seward.

SCIENCE TEACHERS.

To the Editor of the Chemical News.

Sir,—Seeing that the subject of science teachers is under discussion in your columns, I venture to offer a few remarks, in the hope that something will be done to remedy the existing anomalous state of things with regard to science examinations ; feeling, doubtless with many others, that a measur which bids fair to benefit the country, by enlarging the area of our educational basis, is failing from lack of well-directed energy to accomplish its desirable purposes.

It is admitted on all sides that the days when Latin and Greek should monopolise our school hours are at an end, and that it is necessary, in order to effect material progress, that our scholastic system should be modernised by bringing within its range those departments of intellectual culture in which, more especially, such rapid advances have been made in latter years. But I cannot think that the latest step on the part of the authorities at South Kensington is calculated to further the propagation of scientific knowledge, or to facilitate the introduction of chemistry and its concomitant sciences as recognised and essential branches of a middle-class education. I refer to the abolition of the November examinations for teachers, and the amalgamation of pupils and teachers at the May examinations. It is now only necessary for a candidate to obtain a first or second class certificate in order to style himself and act as a "science teacher." Such a sudden transformation of pupils into teachers cannot, I think, be productive of beneficial results ; for it is certainly not a matter of difficulty for a pupil of 16 or 17 years of age, who has applied himself to his subject, to pass in the second, or even in the first class ; but it is very rarely that such a pupil becomes by this circumstance qualified to hold the responsible position of a teacher. It may be argued that there was so little difference between a third-rate teacher and a first-rate student that it was absurd to have separate examinations for them ; but was not this fact sufficient in itself to prove the necessity of raising the standard of examination for teachers, instead of lowering it to that of the pupils ?

This, then, appears to be the root of the evil. The examinations for teachers were never sufficiently stringent, or rather they did not sufficiently touch upon the real work of the teacher, which, in experimental science, is to a great extent of a practical nature. If a separate examination for teachers be again instituted, I would suggest, in order to render it more efficient, that something like the following scheme should be adopted :—

That no candidate should be allowed to style himself a "science certificated teacher" until he has passed in at least four subjects.

That there should be no second or third class ; a certain standard to be fixed which all candidates must reach.

That there shall be a theoretical and practical examination in those subjects which admit of such treatment.

That each candidate shall be obliged to deliver a lecture of not less than half an hour's duration before a committee or board of examiners, on some portion of the subject in which he is a candidate, and that a few simple pieces of apparatus should be provided for the illustration of the lecture.

This last requisite I consider to be of the utmost importance, as lecturing forms the chief portion of a teacher's work, and his facility of expression, as well as his skill in manipulation, might thus be thoroughly tested.

I am of opinion that such a scheme as the above would meet with the approval of the majority of those concerned, and none more than science teachers themselves would appreciate the consequent elevation of their profession in the eyes of the public.

Doubtless objections will be raised on account of the extra time and expense involved ; but has not experience shown that neither time nor money can be more wisely expended than upon education, and never with such certainty of ultimately yielding great and profitable results ?—I am, &c., F. N. J.

October 29.

PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2828. A. Ticozzi, Bedford Street, Bedford Square, Middlesex, "An improved preparation or lotion for diseases of the eyes."

2832. J. Player, Glaisdale, Yarm, Yorkshire, "Improvements in the manufacture and refining of iron and steel."—Petition recorded, October 8, 1867.

2848. T. Blackhurst, Conway Street, Birkenhead, Cheshire, "A new or improved composition to be used to prevent the oxidation of iron, the fouling of ships' bottoms, and other submerged things, and preserving wood from decay and from worms, and also preserving iron and wood exposed to the action of the atmosphere."—October 10, 1867.

2852. A. M. Clark, Chancery Lane, "Improvements in the preparation or treatment of extracts of madder for dyeing and printing purposes, and in apparatus used in such treatment."—A communication from G. A. Schaaff and G. E. Lauth, Boulevart St. Martin, Paris.—October 11, 1867.

2874. E. Leitenberger, Cosmanos, Austria, "Improvements in treating madder for the purpose of obtaining purpurine or alizarine from the same, and in apparatus to be made use of thereby."—October 12, 1867.

INVENTION PROTECTED BY THE DEPOSIT OF COMPLETE SPECIFICATION.

3972. W. Brookes, Chancery Lane, "An improved method of treating hides in the process of tanning, and for apparatus employed therein.—A communication from M. Michaelis, J. Hallenstein, and A. Cleghorn, Footscray, Victoria."—Petition recorded October 22, 1867.

NOTICES TO PROCEED.

2606. G. Pickin, Birmingham, "Improvements in the treatment and preparation of mineral oils and spirits for illuminating and other purposes."—Partly a communication from H. Chadburn, St. Louis, Missouri, U.S.A.—September 16, 1867.

2745. T. Prideaux, Sheffield, "Improvements in blast furnaces or cupolas."—September 28, 1867.

1713. H. Fletcher, Old Hall Street, Liverpool, "Improvements in the manufacture of artificial fuel."—Petition recorded June 11, 1867.

1748. G. Mc Kenzie, Glasgow, N.B., "Improvements in the manufacture of illuminating gas."

1754. C. Erba, Milan. "Improvements on depilation and leather tanning."—June 15, 1867.

1767. F. B. Miller, Sydney, New South Wales, "An improved method of toughening brittle gold bullion, of refining alloyed gold, and of separating therefrom any silver they may contain."—June 17, 1867.

1803. H. K. York, Cardiff, "Improvements in the manufacture of steel."—June 20, 1867.

1819. G. Dickie, Kilwinning, Ayr, N.B., "Improvements in the manufacture of illuminating gas."—June 21, 1867.

1846. T. Crow, West Ham, Essex, "Improvements in the manufacture of illuminating gas from gas tar, oil, or from gas tar."—June 25, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the Chemical News.]

Journal für Praktische Chemie.
No. 12. 1867.

A. Muller, "Colorimetrical Studies on Sulphate of Iron." A. Muller. "On some Chromatic Relations between Solutions of Annatto, Acetate of Iron, and Bichromate of Potash.

Bulletin de la Société d' Encouragement. May, 1867.

Caultier de Claubry "Report on Guenier-Lauriac's Method of Casting Rolls and other objects with a Skin of Hard Iron."

Mittheilungen des Gewerbe-Vereins für Hanover. Nos. 1. and 2. 1867.

F. Kern, "On a new Vegetable Fibrous Material known as *Kollenfilster*, for stuffing Furniture." W. Liecke, "Some Methods of Preserving Cast Iron." W. Liecke, "On Coating Cast Iron with other Metals in the Wet Way." H. Grothe, "On the Amount of Heat radiated from Steam Pipes, and on the use of a Jacket for preventing such Radiation." Begemann, "On the Pollution of Wells by Cesspools and Privies." W. Liecke, "Notes on Glycerine."

Le Technologiste. July 1867.

Oudemans, "On the Specific Gravity of Acetic Acid and of its Aqueous Solutions." F. Junemann, "Improvements in the Manufacture of Beetroot Sugar." H. Robertson. "On a new Distilling Apparatus for the Extraction of Mineral Oils."

Dingler's Polytechnisches Journal.
July, 1867. No. 1.

Blazek, "On a Means of establishing Telegraphic Communication between Two Places without the use of a connecting Wire." J. L. Fromont, "On Ammonia Vapour Pumps." C. Bischof, "Analysis of and Pyrometric Experiments on Grünstadt Fire-clay." G. Schnitzer, "On Citric Acid." M. Rosler, "On the Manufacture of Indigo Carmine." H. Deville, "On the Use of Glycerine for preventing the Adhesion of Mercury to the Glass Tubes of Steam Gauges."

July. No. 2.

H. Scheffler, "On the Use of the Thermometer for preventing Boiler Explosions." L. Rinman, "On the Presence of Nitrogen in Steel and Pig Iron, and on the Condition of Carbon in Hard and Soft Steel." H. Wagner. "On the Manufacture of Baryta and its Salts." M. Rosler, "On the Manufacture of Nitrate of Iron for Use as a Mordant." Chevallier, "A Method of rendering Mortar capable of resisting the Action of Rain by the Addition of Coal Dust thereto." Chevallier, "On the Use of a Solution of Amber in Bisulphide of Carbon as a Cement." E. Sostmann, "On the Solution of Gypsum by Saccharine Solutions." H. Rust, "On the Discrimination of true Creosote and the so-called Coal Tar Creosote (Carbolic Acid)."

Comptes Rendus.
August 19, 1867.

M. Chasles, "On the Pascal Correspondence." Chevreul, "On the Pascal Correspondence." Schultz-Schultzenstein, "Researches on Animal Electricity." C. Ozanam, "On the Representation of the Beats of the Heart and the Pulse by means of Photography." Conte, "Supplement to the Author's Memoir on the Diseases of the Vine, published in the *Comptes Rendus* of August 12." C. Grad, "On the Temperature of the Rivers Rhine, Ill, and Fecht." H. Schiff, "On the Monamines derived from the Aldehydes." L. Cailletet, "On the Influence of Coloured Light on the Decomposition of Carbonic Acid by Plants." Coulvier-Gravier and Chapelas-Coulvier-Gravier, "On the Shooting Stars of the 9th, 10th, and 11th of August, 1867." Jullien, "Letter to Chevreul on Capillary Affinity." Chevreul, "Reply to Jullien's Letter on Capillary Affinity."

NOTES AND QUERIES.

Perfect Vacuum.—I have a recollection that some chemist described a method of getting a perfect vacuum some years ago. Can any of your readers refer me to the exact description?—Electron.

Granular Effervescing Citrate of Magnesia.—It is stated on good authority that there is no citrate of magnesia whatever in the above popular medicine. Is this the case? If so it ought to be widely known. Can any of your readers give me a simple and trustworthy test for its presence in an effervescing mixture?—A Surgeon.

Manufacture of Epsom Salts.—Some weeks ago I noticed a correspondent asking, through Notes and Queries, at what towns in the north, Epsom salt is made on the plan I described in your journal some time ago. I should have answered this before but have been prevented through illness. I now beg to state, if is not too late, that Manchester, Bolton, Wigan, St. Helens, &c., are some of the places working on the plan described.—J. H. Swindells.

Spontaneous Ignition of Charcoal.—Has this phenomenon ever been observed? A case has just come under my notice in which a considerable quantity of finely powdered wood charcoal has been found in a smouldering state. I have carefully examined into the circumstances, and can assign no reason whatever for the ignition except that it occurred spontaneously.—W. Holmes.

Action of Salts on Glass.—It does not seem to be generally known that several ammoniacal salts act on glass at a high temperature. Thus fusing sulphate of ammonia and also a mixture of nitrate and chloride of ammonium, in a state of fusion attack glass. An ignorance of these facts has just led me astray in considering fluorine to be present where it was not.—Medicus.

MEETINGS FOR THE WEEK.

Friday, November 1.

Geologist's Association.—"On the Chief Groups of the Cephalopoda." by Rev. Thomas Wiltshire, M.A., F.G.S., &c.

Monday, November 4.

Royal Institution.—General Monthly meeting. 2 p.m.

Wednesday, November 6.

Geological Society.—First meeting of Session. "On the Loess and Gravel Deposits of the Valley of the Somme," by A. Tylor, F.L.S., F.G.S.

Thursday, November 7.

Chemical Society.—First meeting of Session. "On Nitrous and Nitric Ethers," by Messrs. E. T. Chapman and M. H. Smith. 8 p.m.

TO CORRESPONDENTS.

A. P.—Write to Messrs. Wells and Hall.

A Constant Reader.—You must be very careful how you try the experiment. The apparatus will almost certainly explode.

F. O. X.—You must use slaked lime. Quick lime will not absorb carbonic acid. This is a sufficient reason for your failure.

Bellum.—Bell metal is an alloy of copper and tin, the proportions vary, but they are very near 76 of copper, and 24 of tin.

J. Barnes.—To answer your question it would be necessary to write a complete treatise on the science. We must refer you to the article "Crystallography" in Watts's Dictionary.

W.—Send stamps, and our publisher will forward the book. You ought to be able to get what you want through your local bookseller.

Olympic Company.—The more complex the composition of a glass, the more stable it is supposed to be. A simple silicate is readily devitrified.

Communications have been received from J. H. Swindells; Professor A. H. Church, M.A.; H. Wallis; D. Cameron; Walter Hall (with enclosure); H. Seward; W. Hill (with enclosure); J. H. Dickenson; W. Hoare (with enclosure); J. R. Smith; M. E. Taylor; J. Bird (with enclosure); J. Pain; S. Barnes; M. Willis; R. Newman; W. Delcomyn; G. King; Nicholas Pugh; C. R. A. Wright, B.Sc. (with enclosure); Dr. Odling, F.R.S.; Rev. Edwin Smith, M.A.; W. M. Bywater; E. Bennett; Jesse Fisher.

Books Received.—"Practice with Science, a Series of Agricultura Papers." Vol. i. London, 1867. Longmans and Co. "On the Qualifications and Duties of an Officer of Health," by Dr. Letheby. London, 1867. "Introductory Lecture to the opening of the Eighty-third Medical Session at the London Hospital," by Dr. Letheby. London, 1867. "The Journal of Materia Medica," by Dr. J. A. Bales and H. A. Tilden. New Lebanon, New York. "Scientific American." "American Artisan." "Journal of Gas Lighting." "The present State of Manufacture of Iron in Great Britain," by J. Lowthian Bell. 'Catalogue of American and Foreign Scientific Books for Sale." by D. Van Nostrand. New York. "Mining and Petroleum Standard" and American Gas-light Journal." New York. "Hardwicke's Science Gossip," November.

THE CHEMICAL NEWS.

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THE ATMOSPHERE OF THE METROPOLITAN RAILWAY.

IN another part of this paper we give a full report of the inquiry relating to the air of the Metropolitan Railway. In the interests of the public the results of the scientific evidence here brought forward should not pass without comment. Considering the mode in which gas analyses generally, especially those of air, are performed, the work done by the chemical referees deserves high praise; but the inferences which the public are likely to draw from the condensed reports hitherto published are certainly not justified by a careful analysis of the whole of the evidence. For the sake of clearness we will here give a summary of the details. In the tunnels Professor Rodgers found—

1 of sulphurous acid in	.. ..	40,789 vols,
,, ,, ,,	.. ..	23,913 ,,
13 of carbonic acid in	.. ..	10·000 ,,
18·7 ,, ,,	.. ..	10·000 ,,

The average amount of oxygen found was 20·17 per cent, in one instance sinking as low as 18·7 per cent.

At Box tunnel there were found to be 20·3 per cent of oxygen; at Blackheath tunnel, 20·0; at the Crystal Palace tunnel, 19·7; at Birkenhead tunnel, 20·1 per cent; at Wolverhampton tunnel, 20·3 per cent. These figures are contrasted with Pimlico air, which contains 20·9 per cent.

Such results are very remarkable, and we confess we were not prepared for such a deficiency of oxygen in tunnels. The actual loss of oxygen is known not to be of great importance in itself, but as an indication of impurity it is one of the most delicate tests. When the oxygen is removed in small quantities by simple absorbents, it is not missed, but when it is replaced by the ordinary products of combustion and of respiration, the minutest portions make the deterioration of air evident to the senses. The deficiency here, according to Professor Rodgers, is as much as 20·9 – 20·17, or 0·73 per cent.

The amount of oxygen found in the bowels of the deepest mines of Great Britain was found in an average of several hundred cases to be 20·26, or more than in the Underground Railway, whilst the air of a large city has been found to contain 20·947. Now we can scarcely look on the air of London as worse than that, and we may safely say that if the air of Pimlico had been taken more frequently, a higher average than 20·9 would have been attained, although we agree with Professor Rodgers that 20·9 will be the amount at some times and places. Without being too minute, we have therefore to record the existence in the Underground Railway of an atmosphere more hurtful than that of the average of metalliferous mines.

Besides this, sulphurous acid, one of the evils absent from the mines, is found in the Underground Railway. One volume in 23,000 we consider very high, if we accept, on Dr. Letheby's authority, that 1 in 100,000 would create coughing.

As to carbonic acid, the amount in London streets is less than 4 in 10,000. 18·7 is high for the Underground Railway, although Dr. Letheby is right in saying that crowded rooms contain sometimes more than this.

If we look at the analyses of Drs. Letheby, Bachhoffner, and Whitmore, we observe results different from those of Professor Rodgers. They do not give the oxygen, but say that sulphurous acid to the amount of 1 in 100,000 could not be detected. The carbonic acid found was about 5, although it rose in one case to 9, and in another to 12·7 in 10,000. It is, moreover, worthy of remark that only where the carbonic acid is low are the maximum and minimum shown. In all cases where the quantity exceeds 5·5 parts in 10,000, the air was taken when it was likely to be foulest (4 p.m.) and the *mean* only is given. An explanation why the *maximum* was not given in these cases is certainly due to the public. The oxygen is said not to be deficient, but results are wanting.

We have here two views of the case not agreeing very well with each other, although not in all points contradictory. Both, however, agree in drawing conclusions favourable to the air of the railway. For ourselves we are unable to draw any such satisfactory conclusions; the analyses are not clear. Are we to look on the average air as containing only five or six parts of carbonic acid per 10,000, or are we to consider that it has lost 7 or 8 tenths of a per cent of oxygen, which would indicate a larger amount of carbonic acid? Or, again, are we to believe that there is too little sulphurous acid to do injury, or 5 times more than is needful to make us cough? All these questions still remain unanswered, and yet the Companies are believed by many to have made an excellent case.

If there is a loss of 0·73 per cent of oxygen, where has it gone? We do not find it accounted for either in the amount of carbonic acid or sulphurous acid.

We do not say that this proves the analyses to be incorrect, because the air might have been collected separately for the two analyses, but it certainly proves insufficiency of evidence. The public ought not to be troubled with these discrepancies; the results ought to be laid before them clear and unquestionable: less than this implies imperfect work and deficient time. Chemical referees cannot fail to come to identical results if they work well and long enough.

We can see little good in partially corroborating evidence, or in opposing it with contradiction enough to admit of doubt. The question is not pushed to the utmost, and the public will think exactly as before. And what does it think? Why, that the air is really very bad, and that if chemists have failed to prove it so, so much the worse for the chemists, but the air is no better for all that. They think too that they care little for averages, because a traveller by the Underground Railway does not breathe there a mere average, but at times a real blast from the chimney, in an atmosphere already vitiated. What is the amount of carbonic or of sulphurous acid in that blast? That depends on the coal, and is easily calculated. They will believe, too, that although the air may not be capable of killing a strong man, it is less capable of supporting vitality than the air outside, and it is deadly to those who cannot bear so much impurity, exactly as the air even of London is to those who are so constituted that they must live in the country. To take a delicate organism as an instance; will anyone say that a lark could live in such air as was found? We cannot name the point at which the quality "deadly" begins; it is a matter of degree. There is no doubt that the air is of an inferior description, how bad we do not exactly know; but if it were really desired to be ascertained, numerous experiments should be made, and when there was a diversity of opinion we would have the matter investigated till every point was clear. It does not amount to a scientific inquiry when two sides throw down the dice and shout immediately who has won. The first experiments are generally useful merely to show the difficulties. Time and money are spent in obtaining scientific reports, and again more time and money in obtaining reports to contradict them; but the next step, namely, insisting that they shall agree, is too seldom taken. In this case they do agree in conclusions, we think without sufficient reason.

Perhaps in this case some of the weakness arises from a desire to protect the Company. It would be unwise to blame that body as if its conduct were reprehensible. The Directors must desire pure air more even than the public

desires it, as it would increase both the comfort of the public and their profits. It shows great weakness on the part of the Company to appear at all afraid, or to seek to defend itself. It is enough if the Directors have done their best, and are ready to improve as soon as a method is shown them. The railway is too valuable to be without defenders, and the appointment of persons by the Company to conduct the examination for them weakens their case in the eyes of the public. However honourable these men are, the public will say—"The Directors after blowing smoke into our nostrils, attempt to throw dust into our eyes." It would be far better for them to make no defence at all, but improve the air of the tunnels to their utmost, never resting satisfied until the public ceases to complain.

ON THE

FORMATION OF SUCCINIC ACID FROM CHLORIDE OF ETHYLIDENE.

By MAXWELL SIMPSON, M.D., F.R.S.

SOME years ago * I ascertained that when bromide of ethylene is successively treated with cyanide of potassium and caustic potash ordinary succinic acid is formed. This reaction has since been confirmed by M. Geuther, † who, however, employed chloride instead of bromide of ethylene.

It occurred to me that it would be interesting to ascertain whether the chloride of ethylidene would, when subjected to the same treatment, produce the same or an isomeric acid. One would naturally be inclined to expect the latter result, seeing that the constitution of the chloride of ethylidene is different from that of the chloride of ethylene. The following formulæ will make this intelligible, and show the probable constitution of the isomeric acid:—

CH_2Cl	CH_2Cy	$CH_2(C\Theta\Theta H)'$
CH_2Cl	CH_2Cy	$CH_2(C\Theta\Theta H)'$
Chloride of ethylene.	Cyanide ethylene.	Ordinary succinic acid.
CH_3	CH_3	CH_3
$CHCl_2$	$CHCy_2$	$CH(C\Theta\Theta H)_2$
Chloride of ethylidene.	Cyanide of ethylidene.	Isomeric acid.

It is to be observed that, in the transformation of cyanide of ethylene into ordinary succinic acid, the group $C\Theta\Theta H$ takes the place of each equivalent of cyanogen. In the transformation of cyanide of ethylidene, it is to be supposed that the cyanogen is replaced in a similar manner, an isomeric acid being formed.

In order to determine this point I made the following experiments:—

A mixture of one equivalent of pure chloride of ethyle *chloré*, which is identical with the chloride of ethylidene, two equivalents of pure cyanide of potassium, and a large quantity of alcohol was exposed in a sealed mattrass for twenty-seven hours to a temperature ranging between 160° and 180° C. I had previously ascertained that a high temperature was necessary in order to determine the reaction. At the expiration of this time the mattrass was opened and its contents filtered. The filtered liquor was then treated with solid potash and afterwards exposed to the temperature of a water-bath till ammonia ceased to be evolved. When this was observed the alcohol was distilled off, and nitric acid added in excess to the residue. Finally this was evaporated to dryness at a low temperature, and the liberated organic acid taken up by alcohol. By dissolving in absolute alcohol and crystallising from water, it was obtained quite pure. The quantity I obtained was small; dried at 100° C. it gave the following numbers on analysis:—

	Theory. Succinic acid.		Experiment.
		Per cent	
C_4	48	40·67	40·86
H_6	6	5·10	5·55
O_4	64	54·23	
	118	100·00	

It had, therefore, the composition of succinic acid. That it was the ordinary acid was sufficiently proved by the following properties and reactions:—It melted at 179° C. and sublimed in the form of needles on the application of a higher temperature. The vapour produced, on being inhaled, instant coughing and a painful sensation in the nostrils. The neutralised acid gave an abundant brown precipitate on the addition of perchloride of iron. This test was tried both before and after the body in question had been treated with nitric acid, and with the same result.

The only explanation I can give of the formation of ordinary succinic acid in this case is, that the chloride of ethyle *chloré* was, in presence of the cyanide of potassium, partially converted by the high temperature to which it had been subjected, into chloride of ethylene, one equivalent of hydrogen changing its place with one equivalent of chlorine—

$$\begin{matrix} CHHH \\ | \\ CHCl_2 \end{matrix} = \begin{matrix} CH_2Cl \\ | \\ CH_2Cl. \end{matrix}$$

Since the above was written, I perceive that M Wichelhaus ‡ has formed the isomeric acid from cyanpropionic acid. The difference between it and the ordinary acid is well marked. Its melting-point is 40° lower, and it does *not*, when neutralised, give a precipitate with perchloride of iron. These results correspond with the researches of M. Caventon, who has shown that ordinary glycol can be obtained from the bromide of ethyle *bromé*.

The Star Shower of November 14th, next.—The geographical limits of visibility of the star-shower of 1866, coincide with the area over which the November meteors appeared in 1832. The latter shower was seen as far south as the Mauritius, as far east as Arabia and the Persian Gulf, and over the whole continent of Europe, with the British Isles, but it was not visible in America. It was, moreover, a moderate display, but it was followed, twelve months later in America, by the great storm of meteors which suddenly appeared on the morning of the 13th of November, 1833. The recent exhibition may therefore be regarded as the prelude of a similar meteor-rain in America, perhaps partially visible in Europe, as great and bright as the two star-storms seen in America, and partially visible in Europe, in the years 1799 and 1833. Unless unforeseen curvatures of the meteoric current disturb the geographical boundaries of the display, the first symptoms of the approaching star-shower will be perceived at day-break in England, on the morning of the 14th of November, 1867, when the light of the moon, then three days past the full, and of dawn appearing, will detract something from the numbers and brightness of the meteors. But the same oscillation of the curves in an opposite direction, it should be borne in mind, will bring Great Britain into full view of the centre of the shower, and make the principal spectacle of the meteors visible in Europe before day-break, as well as in America.—*A. S. Herschel.*

* Philosophical Transactions' for 1861.

† Annalen der Chemie und Pharmacie, cxx, p. 268.

‡ 'Zeitschrift für Chemie,' Neue Folge, iii. Band, s. 247.

THE ATMOSPHERE OF THE METROPOLITAN RAILWAY.*

An adjourned inquiry before Dr. Lankester, coroner for the central division of Middlesex, relative to the death of Elizabeth Stainsby, who died suddenly at the King's Cross station of the Metropolitan Railway on the evening of the 28th of August, was concluded on the 30th of October.

In consequence of a suggestion at a former sitting that the impurity of the air in the tunnels of the line might have accelerated the death of the person in question, the Coroner directed a scientific examination of the air of the various tunnels. The result of that investigation was now laid before the jury.

Mr. Hawkins, Q.C., and Mr. Myles Fenton, General Manager of the Metropolitan Railway, attended on behalf of the Company.

The Coroner reminded the jury that, according to the evidence of Dr. Popham, the young woman whose death they were investigating, had disease of the heart; but although a person suffering from that disease might be expected to die suddenly even under ordinary circumstances, the jury might very properly inquire whether any circumstance or condition to which the deceased had been exposed had accelerated death; and in the present instance it was more especially their duty to ascertain whether the condition of the atmosphere in the underground tunnels had had the effect of bringing about the deceased's death sooner than it would have otherwise occurred. Dr. Popham, who had made a *post mortem* examination, said in his evidence that he did not know sufficient of the nature of the atmosphere of the line to be able to say whether or not it had hastened death in this case. Although it had been said by some persons that the atmosphere of the railway really produced no other effect than the external air, there seemed to be a general feeling at the former sittings that the air of the tunnels was different in its quality from the air in the open street; and the question arose whether that difference was due to anything which would hasten the death of any person. For this reason it was determined that an analysis of the air should be made, and he had requested Professor Rodgers to make such an analysis. The railway authorities had been very anxious to get at the truth of the matter, and they had themselves employed some scientific gentlemen to make a similar investigation. He (the Coroner) must say that he regretted that in such cases as the present the Coroner had not a competent official assessor to instruct and assist him, for when scientific men were employed by the parties interested in these cases it often happened that they were supposed to advocate the interests of the side which had sought their services.

At the request of Professor Rodgers, the Coroner read his notes of Dr. Popham's evidence as to the *post mortem* appearances.

Mr. J. E. D. Rodgers was then sworn and examined. He said: I am lecturer on medical jurisprudence and toxicology at the London Hospital Medical College, and I lectured many years on Chemistry at the old St. George's School of Medicine. I am also a member of the Royal College of Surgeons, and Licentiate of Apothecaries' Hall. I have often been employed to give evidence at coroners' courts,—as much, I believe, as any toxicologist in England. I was especially so employed by Mr. Wakley. I hold the coroner's warrant for examining the air of the Underground Railway. I am acquainted with the fact that the illness of the deceased commenced at the Bishop's Road station. Dr. Popham has informed me that her stomach was full of food, and I have also been informed that the dress was remarkably tight round the waist.

The Coroner: We have had no evidence of that fact. Who undressed the woman?

Dr. Popham: I was present. The dress was certainly very tight—more than ordinarily so. I think it was I who cut the stay-laces. They compressed the lungs and chest a good deal. She had no belt, but she wore two dresses.

Professor Rodgers: I have carefully analysed and tested the air contained in the tunnels of the Underground Railway between the Bishop's Road and King's Cross stations. I have done this on four occasions—namely, September 4th, September 10th, October 2nd, and October 28th. With a view to compare the chemical constitution of the air of these tunnels with that of others, I have also subjected to experiments air taken from the Blackheath tunnel, the Gipsy Hill tunnel on the Crystal Palace line, the tunnel between King's Cross and Finchley on the Great Northern line, and the Box tunnel, the Wolverhampton tunnel, and the Birkenhead tunnel, on the Great Western Railway. I have also examined and tested the air of London in as pure a condition as I could obtain it, in order to ascertain the amount of deterioration that that of the tunnels had undergone. The atmosphere in a pure condition consists by volume of 79·19 measures of nitrogen, and 20·81 of oxygen, and every 10,000 measures of air contain from 3·7 to 6·2 measures of carbonic acid. On September 4th I visited the Metropolitan Railway between the hours of 3 and 5 p.m., and tested the general nature of the air, and collected certain portions for subsequent examination. In 17 cubic inches of air taken from each of the five tunnels between Bishop's Road and King's Cross, and tested for carbonic acid (with the exception of the air from the Gower Street and King's Cross tunnel, which contained a more notable quantity), only a slight trace of carbonic acid was indicated. The percentage of oxygen in the samples then taken was—

In the Bishop's Road tunnel	.. .. ..	20·48
,, Edgware Road	,, ...	20·6
,, Baker Street	,, ...	20·3
,, Portland Road	,, ...	20·1

In the air of the tunnel between Gower Street and King's Cross, an opportunity having been watched to get some of the worst air, I found that the percentage of oxygen was 18·7. With this exception the air of the tunnels was not far below the external atmosphere as far as its oxygen was concerned. In travelling backwards and forwards the atmosphere between Gower Street and Portland Road was occasionally unpleasant, but still I felt no faintness or exhaustion from it. On my next visit, September 10th, between the hours of 10 and 11 p.m., I made an arrangement by which I could determine the quantity of carbonic acid and sulphurous acid contained in 775 cubic inches of the air taken from the tunnels during my transit backwards and forwards from King's Cross and Bishop's Road. The result was that the average sample of air contained 13 measures of carbonic acid in 10,000, and one measure of sulphurous acid in 40,789—nearly 41,000. On this occasion also the air taken from the Gower Street and King's Cross tunnel gave clear evidence of the presence of carbonic acid in 17 cubic inches. On my next visit, October 2nd, my object was to ascertain the quantity of carbonic and sulphurous acids in the air of the Gower Street and King's Cross tunnel only, and I found 18·7 measures of carbonic acid in 10,000, and one measure of sulphurous acid in 23,913.

The Coroner: You were getting worse then?

Witness: Rather worse. Then I had the air of that one tunnel in its worst possible condition. On my last visit, October 28th, I tested the air in all the tunnels between the hours of 8 and 9 p.m. and found traces of carbonic acid evident in the 17 cubic inches, the air of Gower Street, on this occasion containing the minimum, and that of Portland Road the maximum. I brought away samples for the purpose of ascertaining the per-

* Specially reported for the Chemical News.

centage of oxygen, and the results of my analysis I will now give you.

Percentage of Oxygen on October 28.

In Bishops Road tunnel	20·5
,, Edgware Road ,, ...	20·2
,, Baker Street ,, ...	20·5
,, Portland Road ,, ...	20·0
,, Gower Street ,, ...	20·4

On October 2nd I found in the Gower Street tunnel the percentage of oxygen was 20·1.

The witness then submitted the following results of observations, which, for the sake of comparison, he had made on the air of different railways :—

Percentage of Oxygen in Air.

Blackheath tunnel (Sept. 28th), ...	20·0
Crystal Palace tunnel (Oct. 2nd), taken in the midst of traffic	19·7
King's Cross and Finchley tunnel	20·5
Box tunnel	20·3
Birkenhead Tunnel	20·1
Wolverhampton tunnel	20·3
Open air of Pimlico (Sept. 21), going from Battersea Park by the S. W. Railway	20·9

The Coroner: Is that the general average ?

Witness: To get the exact determination of oxygen in the air is a matter of considerable difficulty. It would take perhaps many months to determine it exactly.

The Coroner: But that is in accordance with general analyses ?

Witness: It is. My object in making these analyses was fairly to contrast the air of the metropolitan tunnels with that of other situations and other tunnels. The highest point of carbonic acid which I found is 18·7 measures in 10,000. That occurred in the Gower Street and King's Cross tunnel. That is the worst quantity on that line. I must here observe that the quantity of carbonic acid in different airs has been determined by other observers. Dr. Roscoe found that in the atmosphere of a crowded theatre four feet above the stage there was no less than 23·37 measures of carbonic acid in the 10,000 ; and going a little higher (34 feet from the stage) he found 32·12 measures in the 10,000. In the Wellington Barracks it was determined that 2 feet 6 inches from the floor there were 12·42 measures of carbonic acid in the 10,000.

The Coroner: Have you found any fluctuation with regard to the sulphurous acid ?

Witness: No, I have not.

The Coroner: Do you think the deficiency of oxygen likely to act injuriously upon the health of delicate persons ?

Witness: Only if they continued there for some time. Not if they passed rapidly, as they do in the trains.

The Coroner: After all, the deficiency of oxygen appears to be very slight ?

Witness: It is a very slight deficiency.

The Coroner: Except in that one case of Gower Street, where there was only 18 per cent.

Witness: At that time there had been trains rapidly passing, and there was one passing at the time I took the air.

The Coroner: You do not think, then, that the deficiency of oxygen would hasten the death of a person who had already constricted disease of the aorta ?

Witness: I would answer that question in this way, Mr. Coroner. She has diseased heart; she has eaten considerably ; she is tightly laced ; she begins to be faint at a station where the air is unexceptionable—that is, at Bishop's Road. I do not think that under those circumstances the deficiency of oxygen hastened her death.

The Coroner: I will just say to the jury (I do not know whether they understand it) that the deficiency of oxygen is one point to be considered. But here are also two other things,—a redundancy of carbonic acid, and also the presence of a gas which, I suppose, does not exist in the atmosphere at all, namely, sulphurous acid [To the witness]. With regard to the carbonic acid, do you think that that gas would be likely to act injuriously upon a person under those circumstances ?

Witness: Not in the quantity found. It must be borne in mind that under an attack of that kind the respiration would be more feeble, and consequently less air would be taken in, and it would be more slowly taken in.

The Coroner: Then there is the sulphurous acid. Would that be likely to produce any injurious effect ?

Witness: No, not in that quantity. The proportion would not be so great as if an ordinary sulphur-match containing a few grains of sulphur were burned in this room ?

Q. Did you perceive the odour of sulphurous acid gas there ?—*A.* In the Portland Road and the Gower Street tunnels, and occasionally on the passing of some of the trains.

Q. What was the highest quantity that you found of sulphurous acid gas? —*A.* In the Gower Street tunnel, 1 in 23,000.

Q. And you do not think that would be more than would be given by a match lighted in this room ?—*A.* That would be rather more.

Q. There are about 3,000 cubic feet in this room. Now, if found in that quantity would the sulphurous acid produce any feeling of depression upon persons subjected to its effects ?—*A.* I think not.

Q. Then when persons feel this gas so oppressive, do you think that arises from any peculiarity or idiosyncrasy in them, or is there more gas at those times ?—*A.* It might arise from more gas at those times and the heat.

Q. You think there may be more sulphurous acid gas at one time than another ? *A.* Certainly.

Q. Supposing, then, there is less oxygen, more carbonic acid, and more sulphurous acid, at one time than another, do you think there is sufficient ventilation to prevent dangerous results ? *A.* I think that during my last two visits, there was unquestionably sufficient ventilation to prevent such an accumulation of those gases as would be injurious to the public health.

Q. You would not mind going up and down any number of times a day? *A.* No.

Q. Have you seen any of the servants of the railway at all, and questioned them as to the effect of the air upon them ? *A.* Yes. They made no complaint.

Q. They all knew you were examining for the Coroner's court ? *A.* They did : and I would here mention that I have had every facility given to me so that the examination should be perfect.

Q. Would you mind staying all day in one of those tunnels if you were handsomely paid for it ? (Laughter) *A.* Oh, that becomes another question.

The Coroner: I really want to know what is your opinion with regard to the effect of the air upon health. There is a very decided feeling that persons suffer from it. I have had a high pile of letters about it, and amongst other things it is stated that servants of the Company have suffered and gone away. I want to get your opinion as to whether they would be likely to suffer, and to test in your own person whether you would like to stay in those tunnels all day long for a handsome sum.

Witness: My opinion of the air is that it is not an air that you would choose for a dwelling, to be constantly residing in. But I speak of the line simply as a tunnel for travelling ; and, comparing it with other tunnels and crowded places, I think that the air of the Metropolitan Railway tunnels will now bear comparison with any. It is not an air that ought to be chosen as one to dwell in constantly.

Mr. Hawkins: You would not take the air of this room to dwell in ?

Witness: Certainly not.

The Coroner: Can you tell the jury whether it is

known that sulphurous acid has an injurious effect upon health?

WITNESS: Long continued exposure to it unquestionably has. I recollect the experiments of Dr. Turner and another on the influence of sulphurous acid on plants. The mixture in that case was much stronger, being one part of sulphurous acid in 5,000. That atmosphere killed plants. They withered in twenty-four hours. That points to the injurious effect of burning gas in greenhouses. I do not think that animals are so susceptible as vegetables to the effects of sulphurous acid. I do not think that in the hot summer weather, when there is less interchange of air between the tunnels and the outside atmosphere, there would be more carbonic and sulphurous acids and less oxygen than in the months when I examined the tunnels. It seemed to me that the trains passing backwards and forwards ventilated very completely and caused a change of air. I do not think that the tunnels would be more oppressive in hot than in cold weather, because the temperature of the air in the tunnels is rather lower than that of the external air in the summer, and rather higher in the winter. There would always be a difference. When I made my experiments the temperature of the air was 72 outside the tunnels and 69 inside. I cannot say whether there had been any removal of the glass or the windows at Baker Street and Gower Street stations before I took the first atmosphere, which was on the 4th of September. Unquestionably the removal of that glass would make a difference in the ventilation.

A JUROR: I should like to know whether the tests were made in a compartment similar to that in which the deceased died.

WITNESS: I do not know in what class she travelled. For the purpose of convenience I travelled in a third class carriage.

At the request of the Coroner, the witness exhibited and explained the apparatus which he used for the purpose of testing the air. It consisted of three small flasks connected by tubes and communicating with a large bottle of water to which a syphon was attached. The flasks contained baryta in solution; and the tubes were so arranged that when water was drawn off by the syphon from the large bottle, a corresponding bulk of the external air would enter at the flask most remote from the syphon, and pass consecutively through the two other flasks and ultimately into the large bottle, there taking the place of the water drawn off by the syphon. The bulk of the water so discharged was equal to that of the air passing into the flasks. The bottle was of known capacity, and thus the experimenter knew how many cubic inches of air he operated on.

Mrs. ANNIE PEMBRIDGE, who was in the railway carriage at the time the deceased was taken ill, deposed that she did not feel the air of the tunnels oppressive on that evening, and she heard no one complain of its being so. The carriage was a third class. Witness entered the carriage at Portland Road. The deceased was already there. Witness did not hear the deceased say, "What a stink!"

The CORONER asked if any stranger in court wished to give evidence as to the condition of the tunnel atmosphere, but no person came forward for the purpose.

Drs. George Henry Bachhoffner, Henry Letheby, and John Whitmore were then sworn. They presented in evidence a printed copy of a joint report of an examination of the air of the tunnels made by them at the request of the Directors of the railway.

The report was read by Mr. HAWKINS, and was as follows:—

Report of an Examination of the Air in the Tunnels of the Metropolitan Railway.

Having received instructions from the Directors of the Metropolitan Railway Company, through Messrs. Burchell, their solicitors, by letter addressed to Dr. Bachhoffner, to examine and report the state of the atmosphere in the different tunnels on their line, and on the sanitary condition generally of the stations and tunnels, we beg to present the following as the result of our investigations:—

We proceeded in the first instance to obtain samples of the air in the tunnels, and we collected them on three separate occasions, namely:—First, immediately after the trains had ceased running at night; secondly, just before they commenced running in the morning; and, thirdly, in the afternoon between 4 and 5 o'clock, the period of the day when there is generally the largest amount of traffic.

The samples, twenty-eight in number, were taken at different places in each tunnel, and at different altitudes; some near the crown of the arch, some near the ground, and others on a level with the heads of the passengers. These samples were analysed for sulphurous acid, carbonic acid, carbonic oxide, coal gas, and oxygen.

The presence of sulphurous acid was sought for by the most delicate chemical test with which we are acquainted; namely, its action upon iodic acid and starch, which we have ascertained is capable of showing the presence of one part by volume of sulphurous acid in 100,000 parts of air, but we could not in any case discover by such test the presence of this acid; from which we conclude that its volume was less than the above in the tunnels. The proportion of carbonic acid by volume in 10,000 parts of the air in the several tunnels and stations was as follows:—

		Max.	Min.	Mean.
Tunnel between Bishop's Road and Edgware Road 2 a.m. Sept. 3.		4·1	4·1	4·1
Tunnel between Edgware Road and Baker Street	1 to 3 a.m. September 3	5·2	4·3	4·8
	2 to 4 a.m. September 6	5·4	4·7	5·0
	4 p. m. September 7 ..	—	—	5·7
Baker Street Station, 4 p.m. September 10		—	—	6·2
Tunnel between Baker Street and Portland Road	1 to 3 a.m. September 3	6·0	4·6	5·1
	2 to 4 a.m. September 6	4·5	4·2	4·4
	4 p.m. September 7 ..	—	—	6·9
Tunnel between Portland Road and Gower Street	1 to 3 a.m. September 3	6·0	5·1	5·5
	2 to 4 a.m. September 6	6·1	4·5	5·1
	4 p.m. September 7 ..	—	—	12·7
Gower Street Station 4 p.m. September 7		—	—	5·7
Tunnel between Gower Street and King's Cross	1 to 3 a.m. September 3	5·4	4·4	4·9
	2 to 4 a.m. September 6	5·2	4·3	4·6
	4 p.m. September 7 ..	—	—	9·1

The amounts of carbo-hydrogen (coal gas) and of carbonic oxide present were so small as to be barely discoverable by the most delicate processes of analysis. Lastly, we ascertained that the amount of oxygen in the air of the tunnels and stations was not in any case deficient.

These results prove that in no instance was the air found to be vitiated to any material extent, although it will be seen that the air taken in the afternoon was less pure than that taken at night. The researches of Regnault, Bunsen, and other eminent chemists, and more recently those of Dr. Angus Smith, show that what may be termed "model or normal atmospheric air" in cities and large towns consists in every 10,000 parts by volume of

Oxygen	2,096
Nitrogen	7,900
Carbonic acid	4
	10,000

It is the last constituent which when in excess renders the air impure, and, in proportion to its increase, so is the air made unfit for respiration. Experiments conducted by Dr. Bernays and Dr. Angus Smith have shown that in several of our London theatres at about 10 o'clock p.m., in many other places of public resort, and especially in some of our law courts, the quantity of carbonic acid in the atmosphere of those places varied from 10 to 32 parts per 10,000; and from the Army Report (vol. v. page 272) it appears that in some fairly-ventilated barracks at Aldershot the quantity of carbonic acid at midnight amounted to 6·42 per 10,000 of air, and at 5 p.m. it amounted to 7·59 per 10,000; and in Wellington Barracks, from 11·89 to 14·18. Even in the streets of Manchester, in foggy weather, it has amounted to 8 parts per 10,000 of air.

In order to determine the atmospheric conditions of these tunnels by comparison with the condition of the air in the tunnels of other lines of railway, we took samples

of the air from several tunnels near London; and from these, which we designate by numbers only, we obtained the subjoined results:—

Tunnel.				
No.	1—4·7	Carbonic acid	per 10,000	of air by volume.
,,	2—12·1	,,	,,	,,
,,	3—4·6	,,	,,	,,
,,	4—4·3	,,	,,	,,
,,	5—7·8	,,	,,	,,
,,	6—4·5	,,	,,	,,
,,	7—5·3	,,	,,	,,
,,	8—4·3	,,	,,	,,
,,	9—4·2	,,	,,	,,
,,	10—5·1	,,	,,	,,
,,	11—4·3	,,	,,	,,
,,	12—4·2	,,	,,	,,
,,	13—4·6	,,	,,	,,

Our inquiries were next directed to the quality and quantity of the fuel used in the engines, and to the mode by which its combustion is effected. The plan adopted (with which we cordially agree) is to diminish as far as practicable the combustion of the fuel during the passage of the trains through the tunnels and stations. The steam in the boiler is raised in the open air to a temperature and pressure which, by experience and daily practice, is found sufficient to work the trains through the tunnels; and, when the trains come again into open space, fresh steam is then generated sufficient to propel the trains through the next journey, when the process is again repeated; by which means the engine driver is enabled, when passing through the tunnels and stations, to close the fire-box and damper so as merely to keep the fire in such a condition that it may be easily revived at either end of the journey.

The evolution of the products of combustion is thus almost entirely confined to that portion of the journey when the trains are passing through the open spaces.

The coke is of a superior quality, being made from a coal which is known to be more than usually free from iron pyrites, and it is burnt in the ovens for twenty-four hours longer than the ordinary coke generally used upon railways. In addition to which a staff of eight men and a foreman are constantly employed in examining and selecting the coke so as to ensure that none but the best quality of coke is transmitted to London for the use of the Underground Railway.

To determine the per-centage of sulphur in the coke, thirteen samples were submitted to chemical analysis, and these gave an average proportion of 0·26 per cent of sulphur, which is about one-fourth the quantity found in ordinary coke. As regards the coke, therefore, we see nothing to which we can take exception, but, on the contrary, we are of opinion that the best available means are used for obtaining a fuel as free from deleterious matter as possible, in addition to which the combustion of the same is conducted with the view of preventing as far as possible the escape of offensive gases.

The presence of sulphur, or, more correctly speaking, of sulphurous-acid gas, in the tunnels and stations, which at times is appreciable both to taste and smell, more particularly on those days when the external atmosphere is unusually dense, must not be taken as an indication that this gas exists in dangerous quantities. for as little as one part of this gas in 100,000 parts of atmospheric air is strongly perceptible both to taste and smell; and paper moistened with a solution of iodic acid and starch becomes tinged with a blue colour when exposed for a few minutes to air having the above proportion of sulphurous acid. On several occasions we have exposed this delicate test to the air in the tunnels while passing through them, both in the carriages and on the engines; and although the quantity of air thus brought into contact with the test has been considerable, yet it has only been during the time of active traffic that the test has shown the presence of sulphurous acid, and then in an insignificant degree. In addition to the above, we beg to point out another cause whcih communicates to the air, more particularly in the stations, a pungent smell, which, although disagreeable, cannot in the slightest degree be regarded as injurious to health; we allude to the partial combustion of the wood forming the breaks when acting upon the tires of the wheels in checking the speed of the train as it approaches the stations.

The number of trips made by the trains through the tunnels daily amounts to 358, of which 284 are by the narrow-gauge trains, and 74 by the broad-gauge. Each of the narrow-gauge trains occupies 20,000 cubic feet of space, and those of the broad-gauge 23,000 cubic feet. The length of time occupied by each train in passing through the tunnels and stations is ten minutes. There are numerous openings communicating with the external atmosphere above, amounting in the aggregate to 3,164 square feet, and distributed in the following manner: namely, Baker Street station, 1,362 square feet; Portland Road station, 863 square feet; Gower Street station, 939 square feet. The western end of the tunnel at Edgware Road opens into a large area called the yard, and at the eastern end of the tunnel at King's Cross an opening has been made directly into the atmosphere, 40 feet in width, in addition. By an extensive series of thermometric observation, we find that there is an average difference of about 1·7° Fahrenheit between the temperature of tunnels and that of the external atmosphere; the mean outside temperature being 70° Fahrenheit, while the air in the tunnels had a mean temperature of 68·3° Fahrenheit, so that it was 1·7° Fahrenheit colder than the external atmosphere. During the winter months this condition will possibly be reversed; but in either case their will be a rapid change of air by an ascending and descending current. Having regard to the cubical volume of the trains, the short time occupied by them in passing through the tunnels and stations, the large volume of air which they displace, and the increased impetus given to the horizontal movement of the air by the rapidity of their transit, we are of opinion that the vitiation of the atmosphere cannot be of a serious character, and this accords with the results of our analysis.

A careful inspection of the tunnels has also shown that they are well constructed, and are generally dry and free from infiltration of liquid or other matter prejudicial to health, with the exception of a portion of the tunnel between Portland Road and Gower Street; to this we directed the attention of Mr. Fenton immediately after our first inspection; and we are happy to be able to add that the defect was at once attended to, and is now in a perfect sanitary condition.

We find on inquiry that the general health of the employés is such as to afford unquestionable proof of the sanitary condition of the air in the tunnels. From a statement furnished to us by Mr. Fenton, it appears that the per-centage of sickness and mortality of these persons is considerably less than that of the employés on the Great Western Railway. To this fact we may add the results of our own personal inquiries, which fully confirm it, as many of the engine-drivers and guards have been in the service of the Company since the opening of the line. They are to all external appearance robust healthy men, and they have assured us that since they were first appointed they have scarcely had a day's illness.

(Signed) GEO. H. BACHHOFFNER, Ph.D., F.C.S., &c.
HY. LETHEBY, M.B., M.A. &c., Professor of Chemistry in the College of the London Hospital, and Medical Officer of Health for the City of London.
J. WHITMORE, M.D., &c., Medical Officer of Health and Chemical Examiner of Gas for the Parish of St. Marylebone.

Dr. Whitmore stated, in answer to the Coroner, that the glass was not removed from the windows of the Baker Street station until after the first samples of air had been taken for examination. The numbers given in the report were the result of a large number of experiments made on the days stated.

Mr. Myles Fenton stated that the glass from the Gower Street Station was removed at the beginning of the summer, and long before the death in question. The removal was not due to any complaint he had received. Had had no complaint of the atmosphere officially previous to the death. At the opening of the line when it was worked by the Great Western Railway Company, some of the porters were taken ill at the Portland Road station. The reason was that there was no special provision made for securing the most perfect coke, and the drivers were not so skilful in the working of their engines as they are now. When the Metropolitan Company took the working of the line into their own hands they took means to secure the best coke in the country. They believed they had obtained it, though at very great cost. The atmosphere of the line was as good as they could make it, and the proportion of sickness among their men was smaller than among the Great Western Company's men.

Frederick Gibbons, an inspector on the Metropolitan Railway, stated that there had been no complaints of the air on the part of the men employed on the line since the Company had used their own engines and employed good coke. The train in which the deceased travelled was the last but two that night.

Mr. Hawkins stated that twenty-five millions of people travelled by the line every year, and that seventy-two millions had travelled by it from the time of its opening.

The Coroner remarked that there was a slight discrepancy between the examination made by Mr. Rodgers and those made by Drs. Bachhoffner, Letheby, and Whitmore, with regard to the sulphurous acid present in the tunnel air. The latter gentlemen stated that they could not detect it at all.

Dr. Letheby said sulphurous acid could be readily detected when a large volume of the air was caused to play upon the test-paper; but when only 70 or 80 inches of air was collected, they in every instance failed to discover sulphurous acid. The nose, however, was more sensitive than any chemical test. One part of sulphurous acid in 100,000 of air would create coughing. Persons who had an irritation of the bronchial membrane and of the throat would be more susceptible of its effects than others.

The Coroner said that that would account for some persons complaining very constantly of the effect of sulphurous acid in the tunnels. The evidence on the whole had been very re-assuring to the public.

Dr. Letheby said that the smell of the wood-breaks, which became charred as the trains were being stopped, would be more evident to the passengers than the sulphurous acid. Probably the gas evolved at such times was what persons found most oppressive. It would be a carbo-hydrogen, and probably there would be a little acetic acid.

The Coroner: Would that carbo-hydrogen produce an irritating effect?

Dr. Letheby: Yes. When wood is submitted to heat it gives off vinegar and an empyreumatic oil which is very irritating.

The Coroner: It has an irritating effect upon the mucous membrane of the lungs?

Dr. Letheby: Yes.

The Coroner: Do you think that any person with congestion of the lungs, we will say an abnormal congestion from disease of the heart, would be likely to feel this?

Dr. Letheby: There is no doubt there is a difference in the sensibility of the nerve of smell, and also in the sensibility of the mucous membrane of the lungs; but although there may be differences in the recognition of it, I do not think that under any circumstances there would be sufficient to produce any dangerous effect.

The Coroner: The differences amongst persons in perceiving it will account for some persons telling me that they have been obliged to give up travelling by that line in consequence of a sense of irritation after leaving the train.

Dr. Letheby: I have calculated the quantity of sulphurous acid which would be given off by the burning of the coke now used, and I find that if they were to shut the tunnels up from end to end, the burning of the coke for 18 hours would not produce enough sulphurous acid to be dangerous to the most susceptible persons. Sulphurous acid is used as a disinfectant in a much larger proportion than would be present under such circumstances. It enters into the composition of a disinfectant which is used over and over again, and I have never heard of any bad effect from it.

The Coroner: And you know there are cases in which persons live in an atmosphere pervaded by it, as at Luton, where they bleach straw by it, and at other places.

Dr. Letheby: Yes, and it is used also for bleaching blankets.

The Coroner: How much coke is consumed in the tunnels a day?

Dr. Bachhoffner: Two tons.

Dr. Letheby: The coke contains 0·261 per cent of sulphur. 6lbs. of coke are consumed per mile in the tunnels and stations. The length of the tunnels and stations is 11,056 feet, that is 2·09 miles. The cubic contents of the tunnels (without the stations) is 4,606,792 feet. The number of trains passing up and down in the day of 18 hours is 358. If you work that out it will come to this,—that supposing the whole space to be hermetically sealed, and that the whole of the sulphur is burned in a closed atmosphere, the quantity of sulphurous acid produced by the sulphur of the coke in that cubic space of air will amount to 2·95 parts in 100,000 by volume. The sulphur burned amounts to 11·717 lbs. in the 18 hours. That will produce nearly 136 feet of sulphurous acid. That going into a volume of 4,606,792 cubic feet of air gives 2·95 parts of sulphurous acid in 100,000 volumes of air.

The Coroner: That is supposing no change of air during the eighteen hours?

Dr. Letheby: Yes. Well, I say that quantity is quite incapable of doing mischief.

In reply to the Coroner, Dr. Letheby stated that the apparatus he used for ascertaining the proportion of carbonic acid in the air was a contrivance of Dr. Angus Smith, invented for use in mines and crowded places where chemical apparatus could not be conveniently used. It gave quantitative results immediately. The apparatus consisted of an india-rubber ball of known capacity, by means of which the air to be tested was blown into a known quantity of baryta water. Account was kept of the number of ballfulls of air required to produce turbidity in the water, and the proportion of carbonic acid was ascertained by reference to a calculated table accompanying the apparatus. The air of the inquest-room was found to contain 44·4 volumes of carbonic acid in 10,000.

The Coroner: Well, we are very much worse than the tunnel, then. (Laughter).

Dr. Letheby: It is three times as bad as we have ever found it in the tunnel. (The witness then put in the subjoined table.)

Amounts of Carbonic Acid per 10,000 *of Air in different Places.*

1. *Cities and Towns*—

London	from 2·8 to 4·3	Average	3·4
Manchester ..	,, 4·9 to 15·0	,,	5·4
Munich			5·0
Madrid	,, 3·0 to 8·0	,,	5·2
Paris	,, 3·6 to 5·1	,,	4·9

2. *Places of Public Resort*—			
Court of Chancery (doors closed)	.. ..		19·8
,, ,, (doors open)	.. ..		4·8
Chamber of Deputies, Paris	.. .. ..		25.0
Theatres (London) ..	7·6 to 32 ..	,,	14·9
,, (Manchester)	10·2 to 27·3 ..	,,	14·8
,, (Paris)	23 to 43 ..	,,	33·0
3. *Dwelling-houses by Day*—			
From	5·4 to 12·7	,,	7·8
4. *Dwelling-houses by Night*—			
In a study near table			11·8
,, ,, near ceiling			15·6
Bed room at night			28·0
,, ,, window open			8·0
5. *Dormitories*—			
At Saltpetriere..			80·0
Another at ditto.			58·0
Workhouse Ward			125·0
Lodging-house in City			100·0
6. *Schools by day*—			
Various in France ,,	27 to 47	,,	36·0
,, in Germany	20 to 56	,,	39·2
,, in England	9·7 to 31	,,	21·5
7. *Mills and Workshops*—			
,,	28·3 to 30·0	,,	29·1
8. *Barracks at night*—			
,,	11·9 to 14·2	,,	12·8
10. *Cornish Mines*—			
Average of good			8·0
,, of bad			190·9
11. *In Expired Breath*—	350 to 500		425
12. *In Room with Chafing Dish*—			..1400

The Coroner asked Professor Rodgers whether he could account for finding so much more sulphurous acid than the other experimenters.

Mr. Rodgers replied that both he and a gentleman who accompanied him had noticed that some of the trains which passed them seemed to emit no sulphur at all. He had not the remotest doubt of the accuracy of Dr. Letheby's experiments, but he must say that he (Mr. Rodgers) should not have found sulphur if it had not been there. He first obtained sulphite of baryta by means of the sulphurous acid in the air, and he afterwards converted the sulphite into sulphate by means of chlorine. He then estimated the quantity, and finally applied nitro-prusside of sodium as a test to show the existence of the sulphur compound. The weight of the sulphite subtracted from the gross weight of the precipitate showed the weight of the carbonate.

The Coroner: Do you see any objection to that plan, Dr. Letheby?

Dr. Letheby: No; but there is a very small quantity to work upon.

Mr. Rodgers: The balance I used turns at the thousandth of a grain.

The Coroner: Would the quantity of sulphurous acid you found do any harm.

Mr. Rodgers: No.

The use of the iodic acid and starch test for sulphurous acid was then illustrated to the jury by Dr. Letheby. A decided blue tint was produced on the test paper by the fumes from a burning sulphur match.

The Coroner briefly summed up the evidence.

After a few minutes' consultation, the jury returned the following verdict: "That the deceased, Elizabeth Stainsby, on the 28th August was found dying, and did die, from the constricted disease of the aorta, and the jury say that the said death arose from natural causes."

M. R. Radau has just published a most interesting work on Acoustics (Paris. Hachette) with 114 wood-cuts; it contains the new experiments by M. Regnault on sound and kænigon vowels.

PROCEEDINGS OF SOCIETIES.

ACADEMY OF SCIENCES.

October 28, 1867.

(From our own Correspondent.)

Osmogenic Extraction of Sugar.—The Pascal-Newton Forgeries.—Electro Capillary Researches.—The Nerves of Nerves.

M. Payen read a note on the employment in sugar refining of the osmogene apparatus completed by M. Dubrunfaut, in order to separate from the sugars the crystallisable salts.

The molasses, which refuse to crystallise, contain in general fifty per cent of crystallisable sugar, half of which is recovered by the osmotic process. Osmosis is more profitably applied for eliminating the salts of the syrups obtained by the forced straining of the first and third portions of the crystallisation, which yield more syrup, and thus give results calculated to economise the apparatus crowded together in the works.

"M. Dubrunfaut," adds M. Payen, "has also found a method for the assay of raw sugars, which indicates not only the total quantity of sugar, but that of the mineral salts. One part of the saline residue of incineration corresponds, in the mean, to the formation of 7·45 of molasses containing 3·73 of sugar uncrystallisable as long as salts are present. This method is generally adopted at the present time.

A member of the Zollverein, relying upon the authority of Dr. Shreiber, recently declared that he he had found by experiment that the salts in molasses, especially the nitrates and chlorides, did not hinder the crystallisation of the sugar. But in studying directly and separately the influences of the alkaline nitrates and chlorides, M. Payen has arrived at the following conclusions: nitrate of potash in various proportions, does not hinder the crystallisation of sugar, chloride of potassium exercises an influence in making the crystallisation slower, and chloride of sodium acts in the same way, but more powerfully.

November 4, 1867.

M. Arthur Chevalier deposited a sealed packet containing the description of a new apparatus.

Sir David Brewster, responding to the appeal of M. Chasles, has asked Lord Portsmouth, Lord Macclesfield, and the Director of the British Museum, if in the collection of autographs in their possession there were not some traces of relations between Pascal and Newton, and the efforts made by Messrs. Winthrop and Robertson to purchase from the Chevalier Blondeau de Charnage the compromising documents which M. Chasles now possesses. The answer of Lady Macclesfield is negative; that of Lord Portsmouth has not yet come to hand, but Sir David, who has had for a long time in his hands the autographs which he possesses, does not fear to affirm also to the contrary. The Director of the British Museum recognised that his collections possess in fact a great number of documents from the cabinet of M. Desmaizeaux; that they form four great volumes, but that no correspondence is found between Newton and Pascal. Sir David, as we have foreseen, rushes into the conclusion that Desmaizeaux is the forger himself—Desmaizeaux, the intimate friend of Newton, who would have done him an injury, while he refused to Fontenelle, for his eulogium of Newton, and to many others, the documents relative to the relations between Newton and Pascal!

M. Chasles answered that he is glad of the declaration of the Director of the British Museum, for the comparison between the two series of manuscripts will certainly prove the authenticity of many of his documents, as, for example, those of Liebnitz, and he mentioned that all these papers are not from the Desmaizeaux collection. Many are from Msme. de Perier, Dreux du Radier, Madame de Pompadour, &c.

M. Chasles presented also four series of photographs taken by reflected or transmitted light. Four of these autograph letters demonstrate invincibly, according to the artist (M. Murcit), an ancient pupil of the Saint Barbe College, that the ink on the paper has really as ancient a date as the water mark, and corresponds to that on the letters.

M. Becquerel, sen., read an additional note to his electro-capillary researches. He shows definitely that —1. The alteration exerted on the sides of the capillary spaces between two liquids. 2. The electricity disengaged at the contact of these liquids in the capillary spaces. 3. The electric conductibility of the sides covered with liquid. He has happily modified his method of experimenting. Instead of forming the fissures in the tubes he fastens at their extremity a strong stopper very tightly fixed, made with filtering paper soaked in water; a platinum wire traverses the stopper and connects the two liquids together.

M. Trecul answered at great length, and we think victoriously, the objections made by the celebrated botanist, Shultze, to his obser vations on the laticeferous organs of plants.

M. Peligot read a *resumé* of his very long researches on the part played by soda in plants.

M. Charles Robin announced that M. Sapey had discovered the nerves of nerves, *nervi nervorum*, the existence of which was well known, but not well observed. He examined by a microscope the mucous membrane and found that they formed round each nerve so many fibrous nerves that enclosed a canal in which the nervous pulp was lodged.

M. Robin presented also, in the name of M. Blondeau, Professor of the Laval Lyceum, the result of the experiments made relatively to the action of induced electricity on the seeds of plants.

M. Edmond Becquerel communicated some curious experiments of M. Bouchotte, of the electrolytic power of the currents of the magneto-electric machine of the Alliance Company. When the current sent by the commutator is always in the same direction, the electrolytic power is that of 144 Daniell elements with sulphate of copper; but when the current is alternate, as in the production of the electric light, the electro-motive power is *nil*.

M. Duchartre communicated with great praise the curious and interesting experiments of M. Joseph Balsamo, Professor of Physics at the Royal Lyceum, Lecce (Provincia de Otranto) Italy, on the production by hybridation of new sorts of cotton. He has succeeded in the fecundation, one after the other, of long-staple, short-staple, &c. He has obtained interesting varieties, which, if they multiplied, would render great service to the industrial world. One of the principal aims of M. Balsamo was to create a species of cotton the maturity of which would be more advanced, and which would be proof against the autumn rains, which in the south of Italy form one of the greatest obstacles to the indigenous culture of cotton.

F. Moigno.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, Nov. 5, 1867.

Tar Water.—Leaden Electrodes.—Production of High Temperatures.—Father Secchi and the Roman Observatory.—Self-registering Barometer.—Paraffin Lubricants.

M. Guyot, an apothecary in Paris, has made a sort of concentrated tar-water, which he calls tar-liquor, calculated to render great service to the medical world. The great advantage of this preparation is to be able to furnish water more or less charged with tar, according to the affection to be treated. This preparation is free from any quackery and has given the best results.

The employment of tar-water is of old date. The discovery of its medical properties is due to Bishop Berkley. This intrepid missionary embarked at the end of the 18th century for Rhode Island. The ship, having remained becalmed for several days in the midst of the ocean, was attacked by a terrible epidemic which decimated the crew. Some of the sick, lying at the bottom of the hold, the prey to a terrible fever, burning with thirst, drank the bilge water of the ship which was impregnated with tar. It was well they did so, for all those who drank of the water were rapidly cured. Berkley, a skilful and profound observer, remarked at once that it was the tar water which cured them, and by drinking it abundantly himself he was preserved from the contagion. On his return to Europe he experimented incessantly, and hastened to publish to the world, in a very interesting volume, the virtues of tar-water.

M. Planté has forwarded to the Society of Encouragement a plan by which platinum electrodes can be replaced by leaden ones. A short time after, he proposed this substitution in order to prove the superiority of the secondary current produced with lead over the secondary current furnished by platinum. He showed to the Academy of Sciences, at the meeting of March 26th, 1860, the powerful effects obtained with a secondary pile with leaden plates of great surface. M. Leon Foucault wrote on this subject on 7th June, 1860:—

"M. Jacobi employed secondary piles in platinum, but M. Planté employed, almost at the same time, lead, as being preferable to platinum, not on account of the economy, but certainly by reason of the secondary reaction. And to show in a striking manner the superiority of lead for this purpose, M. Planté has constructed at very little cost a secondary pile of great power, which can become in the hands of physicists an instrument of value. Lead, flexible and supple, is found in commerce, laminated in thin sheets, &c. Experiments have proved that two simple leaden wires polarised were able to produce a sufficiently intense secondary current to destroy residual magnetism that could not have been neutralised except by a platinum battery of a great number of elements."

On 13th May, 1861, M. Planté presented to the Academy of Sciences, in a sealed letter, the substitution of lead for platinum, in order to obtain a greater quantity of ozone in the decomposition of water by the pile. He subsequently, being attached to the establishment of M. Lenoir, when the process of round casting is carried on by electro-decomposition, essayed with perfect success cores of lead placed in the moulds.

By the invention of the copper soluble anode M. Jacobi has happily completed his discovery in electro-metallurgy.

By the employment of the insoluble platinum, M. Lenoir has been able to succeed in the galvanic reproduction, in a single piece, of solid objects.

Introducing in his turn the lead anode, M. Planté has made an important improvement in the same direction.

In metallurgical operations in crucibles, M. Douenne has succeeded in diminishing the length of the operation and reducing the cost of fuel without having need of more blast. It also completely does away with smoke. Steam, admitted in the form of a jet, is decomposed into the elements of which it consists, oxygen and hydrogen, by which the oxygen combines with the carbon and hastens the combustion at the base of the crucible: the hydrogen, disengaged, being in a medium of higher temperature, rises around the crucible, when it is burnt by the air. The necessary temperature of fusion is thus produced at the proper point by the combustion of the gases resulting from the excessive temperature.

We have received from our illustrious colleague, the Reverend Father Secchi, Director of the Observatory of Rome, and who has just quitted Paris to return to his post, a letter which grieves us much. We cannot forget that in, 1848 his predecessor, Father Vico, author of some great discoveries, was driven from Rome by violence and went to live in America, for which place we procured for him a free passage! We hope that the same lot will not befal Father Secchi, and that he will be free to illuminate the

Pontifical Observatory with new discoveries. M. Francois Arago was also instrumental in the protection granted to the learned and excellent Father Vico, who died, not in America, but at London, 15th November, 1848.

M. Brequet, the well-known clock and scientific instrument maker, has exhibited at the Champ de Mars a new self-registering barometer called the *Barometrograph*, giving indications every six hours, by diagram, of the pressure of the atmosphere. It consists of four metallic boxes, the upper and lower of which are undulated (the usual aneroid barometer); a vacuum is made in each of these boxes separately, and they are attached to a chain the movement of which is four times greater than that of a single box for the same variation of pressure. A steel spring of great strength acts upon these boxes in a contrary direction to the atmospheric pressure, and communicates with an indicating lever. The registration is effected on a cylinder which revolves by means of an ordinary clock; it makes a complete revolution in a week and carries a glazed paper, which is covered with lampblack by being held over the flame of a candle; the extremity of this lever, very fine and pointed, traces a line of variations in a white streak. The periods (4 times a day) are represented on the diagram by vertical lines, and the barometric readings by horizontal lines placed a millimètre apart, the arm of the indicator being so arranged as to mark the variations on the same scale as a common mercurial barometer. This instrument has none of the errors of the common aneroid barometer resulting from the great number of pieces, levers, articulations, gearing, connecting chains, and springs.

A new application of paraffin has been made by M. Monnet for lubricating machinery. The great difficulty was in procuring a lubricating substance that would not melt at a lower temperature than from 300° to 400° Centigrade, and cheap enough to be employed at Lyons on a large scale. Now, the class of paraffins furnishes a substance called melen ($C_{40}H_{60}$), insoluble in water, soluble in fatty oils, volatile without decomposition, and only boiling at above 370°, while at the ordinary temperature it has the consistence of wax, and floats freely on water. Its degree of softening at the temperature of the hand, from 15° to 20° C., is already sufficient to form between surfaces in contact a thin sheet of melen, and according as the heat increases the substance becomes softer until it acquires a complete liquidity which is uniformly kept up.

The following are the advantages arising from paraffin or *melen* lubrication:—

1. During the working of the machine the lubricating substance is very fluid, oily, and unalterable. The melenic particles, carried by the steam, clot together on the surface of the condenser, and can be removed without difficulty.

2. When the motion has ceased the paraffin remains fixed and becomes solid much quicker than lubricating oils commonly in use, which are fluid at ordinary temperature.

3. When the machine is set in movement, the paraffin adherent to the surfaces to be lubricated is melted at once, while the steam gives its heat to the mass of metal of the receptacle before it acts upon the piston. The high temperature of the elastic fluid soon equalises the temperature, and the fusion of the paraffin takes place.

F. MOIGNO.

Death of the Earl of Rosse.—With regret we announce the death of the Earl of Rosse, who expired, after a lingering illness, at Birr Castle, King's County, on the 31st October, in the sixty-seventh year of his age. His name will always be associated with astronomical research and discovery, and with the gigantic reflector known by his name. He was President of the Royal Society in 1849, and he held the Chancellorship of the University of Dublin two years before his decease.

CORRESPONDENCE.

ON THE OCCURRENCE OF SULPHOCYANIDE OF AMMONIUM IN GAS MAINS.

To the Editor of the Chemical News.

SIR,—The existence of sulphocyanide of ammonium in gas mains, even at considerable distances from the gas works, is of very constant occurrence; and it is not carried by the gas, as Mr. Hart suggests in his paper before the Manchester Philosophical Society,* but is produced in the mains and service apparatus by the action of the ammonia in the bisulphide of carbon contained in coal gas, thus:—

$$2NH_3 + CS_2 = NH_4CNS + H_2S$$

This may at any time be proved by passing the purified gas supplied to the public through hydrate of lime, and soon, if ammonia be present, the lime will be found to be charged with more or less of sulphocyanide of calcium.

This reaction will account not only for the presence of sulphocyanide of ammonium in the water of all the hydrants and water meters of a district, but also for the ferrocyanide and sulphide of iron which are so commonly found in the iron mains.—I am, &c. H. LETHEBY.

College Laboratory, London Hospital, November, 5, 1867.

SILICEOUS STALACTITES.

To the Editor of the Chemical News.

SIR,—As a matter of curious interest I send you specimens of siliceous stalactites of peculiar origin. In the manufacture of "superphosphate" from phosphates of fossil or mineral character, a snow-like substance is abundantly deposited in the flues, &c. This is silica, and has its origin in the action of the sulphuric acid upon the fluoride of calcium present in the phosphates. Fluoride of silicon is given off as a gas, which is carried on with the dry steam, but when the latter becomes moist, is decomposed, giving rise to hydrofluosilicic acid and silica. For the first time in my experience this deposit of silica has taken the form now sent. Probably some of your readers may have met with better examples.—I am, &c.,

CHARLES F. BURNARD, F.C.S.

Nov. 2, 1867.

MISCELLANEOUS.

Royal Institution of Great Britain.—The following lectures have already been decided upon:—The Christmas lectures, adapted to a juvenile auditory, will be delivered by Professor Tyndall, LL.D., F.R.S. Subject—Heat and Cold. Professor Tyndall will also deliver ten lectures on "the Discoveries of Faraday." Professor Roscoe, F.R.S., will deliver eleven lectures on "the Chemistry of the non-Metallic Elements." George Scharf, Esq., F.S.A., will deliver six lectures on "Historical Portraiture of various Times and Countries;" and Professor Foster will deliver four lectures on "the Development of the Chick in the Egg." The Friday evening meetings will commence on January 17, when a discourse will be delivered by Professor Tyndall. After Easter, eight lectures in continuation will be delivered by Professor Foster on "the Development of the Chick in the Egg;" four lectures by Professor Odling, F.R.S., on "Chemical Combination;" and four lectures by Professor Bain, on "Popular Errors."

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* CHEMICAL NEWS, p. 229.

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent. 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2549. F. Tolhausen, Boulevart Magenta, Paris, "An improved process and apparatus for instantaneously disinfecting fæcal and manuring matters, improving the same, and also rendering them fit for feeding domestic animals."—A communication from L. J. B. A. Lemoine, and A. M. Turrel, Paris.—Petition recorded September 9, 1867.

2893. A. Aitchison, Wilton Terrace, Peckham, Surrey, "Improvements in the treatment of hydrocarbons for the production of gas sufficiently permanent to be stored for lighting and heating purposes, and especially in the treatment of the hydrocarbons and other products obtained by distilling or carbonising coal, wood, and other carbonaceous materials, including those obtained in the manufacture of gas and in the distillation of coal-tar.

2894. T. H. Baker, and T. Woodroffe, Tonbridge, Kent, "Improvements in treating sewage or other liquid matters so as to purify the more fluid portions thereof, and recover some of the contained matters for use in manufacturing processes, and in the preparation of others for use as manures."—October 15, 1867.

2918. J. Bannehr, Exeter, "Improvements in apparatus for supplying deodorising matter to dry or earth closets, and in processes of and apparatus for treating the liquid portion of human or animal excreta after removal from such closets or from other receptacles."—October 17, 1867.

NOTICES TO PROCEED.

1747. J. Onions, Devon Place, Newport, Monmouthshire, "Improvements in the manufacture of iron and steel."—Petition recorded June 15, 1867.

1886. C. O. Heyl, Berlin, "An improved method of and apparatus for making sulphuret of carbon."

1887. C. O. Heyl, Berlin, "An improved method of and apparatus for extracting fatty matters from and for scouring wool and other fibrous substances and textile fabrics, by the use of sulphuret of carbon, and for regaining the sulphuret used in such operation."—June 28, 1867.

1897. C. O. Heyl, Berlin, "An improved method of and apparatus for extracting oil or fatty matter from cotton or woollen waste, shoddy, mungo, rags, and analogous substances, by means of sulphuret of carbon."—June 29, 1867.

2011. W. E. Newton, Chancery Lane, "Improvements in the processes of and apparatus for the rectification and purification of alcohol."—A communication from J. G. Bequet. and H. Champonnois, Rue St. Sebastien, Paris.—July 9, 1867.

2801. J. Anderson, Londonderry, "Improvements in obtaining chlorine, sodium, potassium, phosphorus, and their compounds."—October, 5, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Comptes Rendus. August 26.

E. BLANCHARD, "Remarks on the Pascal Correspondence." CHASLES "Remarks on the Pascal Correspondence." REGNAULT, "Remarks on the Pascal Correspondence." BALARD, "Remarks on the Pascal Correspondence." CHEVREUL, "Remarks on the Pascal Correspondence." A. W. HOFMANN, "On a new Series of Homologues of Hydrocyanic Acid." FAUGERE, "On the Authenticity of the Pascal Correspondence." PRAT, "Researches on the Chemical Constitution of Fluorine Compounds, and on the Isolation of Fluorine." CHEVREUL, "Remarks on the Foregoing Paper." POOL, "Second Note on an Explosive Compound obtained by treating Glue with Chlorate and Ntirate of Potash." LEON, "On the Changes in the French Monetary Standards occasioned by the Introduction of the Decimal System. (Second Note)." LIPPMANN AND LOUGUININE, "On the Synthesis of Di-Ethyl-Toluol." M. SIMPSON, "On the Formation of Succinic Acid from Chloride of Ethylidene." A. OPPENHEIM, "New Researches on the Isomerism of Protochloride of Allyl and Monochlorinated Propylene." J. CHMOULEVITCH, "Researches on the Influence of Heat on the Mechanical Work of the Muscles of the Frog." R. RADAU, "On a Self-registering Meteorological Apparatus invented by Magellan in 1782, and on the Theory of the Static or Steel-yard Barometer."

Bulletin de l'Academie Royale de Belgique (Classe des Sciences). July 6, 1867.

KEKULE, "Report on T. Swart's Memoir on the Derivatives by Addition of Itaconic Acid and its Isomers." KEKULE, "Report on C. Glaser's Researches on some Derivatives of Cinnamic Acid (Part 2)." STAS, "Report on the two previous Memoirs." MELSENS, "Researches on Yeast and on the Fermentation of Beer." A. QUETELET, "On a Meteor observed on the 11th of June, 1867." A. QUETELET, "On a remarkable Thunderstorm at Ghent on the 2nd-3rd of June, 1867." T. SWARTZ, "On tLe Derivatives by Addition of Itaconic Acid and its Isomers. (Part 2)." C. GLASER, "Researches on some Derivatives of Cinnamic Acid. (Part 2.)"

NOTES AND QUERIES.

Spontaneous Ignition of Charcoal.—Mr. Holmes will find this subject fully discussed in Dr. Taylor's "Principles of Medical Jurisprudence," published two or three years ago.—F.R.S.

Spontaneous Ignition of Charcoal.—In reply to "W. Holmes," an occurrence of this sort is certainly rare, but it is not unrecorded before. In the *Philosophical Magazine* for 1833 (vol. 3. p. 1.) a case is mentioned. In the same volume, p. 91, Mr. Davies attempts to assign the cause of the spontaneous ignition of charcoal. He suggests that during its manufacture a small quantity of potassium is formed, and adduces several reasons why this should be the case.—SCRUTATOR.

Storm Glass.—Will you allow me to ask Mr. Tomlinson for an explanation of the following, which I have often remarked in my storm glass? If it is left hanging up in my window undisturbed for a long time there gradually collects on the surface an oily-looking layer of a lightish brown colour, extending downwards faintly until it is lost in the pure white of the saline contents of the tube. If the storm glass be inverted, and the contents mixed up, the oily-looking liquid and the colour quite disappear, and some weeks elapse before they again make their appearance on the surface.—A CONSTANT READER.

Bleaching Palm Oil.—The want of success of your correspondent, Geo. Johnson, in bleaching palm oil appears to be at least partly due to his not using a sufficient quantity of hydrochloric acid. In order to complete the decomposition of one part of "Bichrome," 1·93 parts of HCl are requisite, the decomposition taking place according to the reaction,

$$K_2O_2CrO_3 + 14HCl = 7H_2O + 2KCl + 2CrCl_3 + Cl_6;$$

but as the strongest liquid muriatic acid only contains about 40 per cent of HCl, and as the commercial acid is frequently much weaker, at least 4·8 or five parts of acid should be used for one of "bichrome," in order to obtain the whole available bleaching powder. In practice, a mixture of sulphuric and hydrochloric acids is frequently employed; about the following proportions have given good results: 1lb. bichrome, 4 to 5 lbs. yellow muriatic acid, ¾ to 1lb. sulphuric acid. Instead of agitating by paddles, air may be blown through the mass with advantage, as a better intermixture is thereby obtained, and labour saved; probably also the air assists in oxidising the colouing matter.

Sulphuric acid alone with bichrome has the advantage of not causing deleterious chlorine fumes, to the great comfort of the workman; it is, however, said to be less efficacious for some kinds of oil than the mixture of acids, and to require a longer time. The cheapest method appears to be exposure of the oil in a layer of about 1½ to 2 inches on the surface of water heated to 100° C. by steam to the combined influence of air and sunlight; it requires, however, a much longer time than the bichrome plan. By passing superheated steam, alone or mixed with air, at a temperature of 110° to 112° C. through the oil, the colour is almost entirely destroyed. Your correspondent will find further information in "Richardson and Watts's Chemical Technology,' vol. i. part 2, p. 410; also in "Ure's Dictionary of Arts," &c., iii. 390.

In performing the bichrome bleaching process, the green liquid left after the first batch of oil has been bleached may be mixed with fresh bichrome, and a less quantity of acid than that first used added, and the whole used for a second batch: any bichrome left in the green liquor is thus utilised. By addition of excess of lime-paste to the spent chromic chloride, a precipitate of lime and chromic hydrate is obtained; this on drying and roasting with access of air furnishes a chromate of lime, which may be used instead of fresh bichrome, thus diminishing, with careful workmen, the cost of the process.—C. R. A. WRIGHT, B.Sc.

TO CORRESPONDENTS.

W. Schofield.—Received.

G. Johnson.—A letter is waiting at our office. Please forward, address where it is to be sent.

F. R. S.—The lecture appeared in full in the CHEMICAL NEWS, but was not published separately. We do not know the other works named.

T. Tyrer.—We regret that we cannot give the information required. Hunt's Mineral Statistics would probably give what you want.

N. Thompson.—No other place except the one referred to.

J. Smith.—If you can send the No. of the CHEM. NEWS containing the lecture, the publisher will foward the copy.

Communications have been received from J. Thompson; H. Baden Pritchard; C. F. Burnard; J. Cliff; W. Spalding (with enclosure); F. O. Ward (with enclosure); A. E. Sansom; G. Griffith; D. Forbes, F.R.S. (with enclosure); J. H. Howard; T. Stevenson (with enclosure); R. M. Hands; W. H. Harrison; C. Manby; J. Forrest; Dr. A. E. Nordenskiold (with enclosure); W. Schofield (with enclosure); F. Zeuner; J. Collins (with enclosure); W. Gibbs; S. Longman (with enclosure); Dr. E. Rohrig; W. Bremmer; Dr. R. Angus Smith, F.R.S.; W. Tobister; C. R. A. Wright; D. Day, F R.S. (with enclosure); W. Hall; Professor Heaton; Dr. Letheby; T. Bourne; T. Miller.

Books Received.—"A Peep at the Pyrenees," by a Pedestrian. London: Whittaker and Co. "The Microscope in Geology," by D. Forbes, F.R.S. London: Hardwicke. "Undersokning af Selenmineralierna fran Skrikerum," af A. E. Nordenskiold. "American Artisan." "American Journal of Mining." "Pharmaceutical Journal" for November. "Scientific Mining Press." "A Dictionary of Chemistry," Part 42, by H. Watts, B.A., F.R.S. London: Longmans. "The Industrial Partnerships' Record," for November. "The Scientific American," "The World of Science." "Le Moniteur Scientifique." Paris.

THE CHEMICAL NEWS.

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THE CHEMICAL NEWS.

Vol. XVI., No. 415.

PRELIMINARY NOTICE OF

RESULTS ON THE COMPOSITION OF WHEAT

GROWN FOR TWENTY YEARS IN SUCCESSION ON THE SAME LAND. (ABSTRACT.)

By J. B. LAWES, F.R.S., &c., and J. H. GILBERT, Ph.D., F.R.S.*

The results had reference to the produce of a field in which wheat had now been grown, on some plots without manure, on one with farm-yard manure, and on others by different artificial mixtures, for twenty-four years in succession (1843-4 to 1866-7 inclusive). At the Cheltenham Meeting of the British Association, in 1856, the authors treated of the effects of season and manures on the composition of the crop as illustrated by the results of analysis relating to the produce of some of the plots during the first ten years of the experiments. At the Manchester Meeting, in 1861, they recurred to the subject; the analytical results, which then extended to the produce of some of the plots for sixteen years, were, however, chiefly applied to the illustration of certain points in connection with the exhaustion of soils. At the Nottingham Meeting, in 1866, they treated of the accumulation of the nitrogen of manure in the soil of the same experimental field. The results adduced on the present occasion showed the effects of season and manuring on the composition of both the grain and the straw during twenty years of the experimental growth.

The particulars of composition given are the percentages of dry substance, of mineral matter, and of nitrogen, and the constituents of the ash of both grain and straw, more than 200 complete ash-analyses being brought to bear on the subject; and, side by side with these, as indicating the general characters of the produce of the different seasons and plots, are given the proportion of corn to straw, and the weight per bushel of the corn.

In the case of the plots without manure, with farm-yard manure, and with ammonia-salts alone, every year, the ash of the grain last 16, or more, and of the straw of the last 16, of the twenty years, had been analysed; and in the case of 9 differently manured plots (including the above 3) the ash, of both corn and straw, of the first, the last, and two intermediate seasons (one bad and one good) of the last 12 of the 20 years had been analysed. It was the intention of the authors to publish the results of the investigation in detail before long; and on the present occasion they confined attention to a few of the most prominent effects of the respective manures on the composition of the crop, when thus applied for so long a continuance, year after year on the same plot.

It is first pointed out as remarkable, though fully established by their results from the commencement, that variation in manure, even though maintained for many years in succession, and resulting in great variation in amount of produce, affects comparatively little either the proportion of corn to straw, or the weight per bushel of corn, excepting, indeed, in a few extreme cases of abnormal exhaustion or repletion. Nor do the percentages of dry substance, of mineral matter in dry substance, or of nitrogen in dry substance, vary much under the direct influence of variation in manure, unless again in very abnormal cases. Very different, however, is the effect of season; the variation in the character of the produce, in every one of the above particulars, being much greater in different seasons with the same manure than with different manures in the same season.

Consistently with these broad facts, the composition of the ash of the grain is found to be pretty uniform under a great variety of manurial conditions in one and the same season, only in a few extreme cases of special interest varying in any material degree. The same may be said in some, though in a much less degree, of the composition of the ash of the straw, which is obviously much more directly affected by the character of the supplies within the soil.

The general result is that (excepting in a few abnormal cases) the variation in the composition of the ash of the grain is limited to the slight variations due to differences of development and maturation, which, in their turn, are much greater with variation of season than with variation of manure. The composition of the ash of the straw, on the other hand, much more nearly represents the total mineral matters taken up by the plant, and much less the character of development of its own more fixed and essential constituents. In other words, whilst there may be considerable range in the composition of the matters taken up by the entire plant, the tendency in the formation and ripening of the ultimate product, the seed (whether produced in small quantity or large) is to a fixed and uniform composition, the deviation from which is little directly affected by the character of the supplies within the soil, but much more by the various influences of season.

The deviations from the point of fixed and uniform composition, thus due primarily to variations in climatic circumstance, are, however, when considered in relation to other characters of the grain, sufficient to show the general connection between the comparative predominance of individual constituents and that of certain general characters of development. A few illustrations were given; but the fuller treatment of the subject, in its bearing on these as well as on other points, was reserved until the results could be considered in the detail necessary to their proper elucidation.

One point of interest prominently brought out by the results relating to the composition of the straw-ash was, that a high percentage of silica was almost uniformly associated with a bad, and a low percentage with a good condition of the produce—a fact to which the authors had on former occasions called attention, but which, as was remarked by the President, was quite inconsistent with the generally accepted views on the subject.

* Read in Section B at the British Association Meeting, Dundee.

VERIFICATION OF THE

LAW OF HENRY AND DALTON

FOR THE

ABSORPTION BY LIQUIDS OF CARBONIC ACID GAS.

By M. KHANIKOFF.

The absorption of gases by liquids was known to natural philosophers at the end of the seventeenth century; but the first important observations on this subject were made by Cavendish and Priestley.

At the beginning of this century, in the year 1803, Dr. Henry formulated a law of absorption of gases which is very simple—namely, he concluded from his experiences that the absorption is directly proportional to the pressure and inversely to the temperature. Nevertheless, it was evident that in the expression of the power of absorption possessed by liquids, in so simple a manner, the pressure and temperature could only be rough approximations, and that in reality a phenomenon so intimately connected with the molecular structure of the liquids could not be expressed in such an uncompounded form. For if this law were admitted without limitations, an unlimited

absorption of gases must also be admitted,—already impossible for all gases, especially for coercible ones. Dr. Henry, by the nature of the apparatus that he constructed for his researches, could not come to any other conclusion. His apparatus consisted simply of a glass bell, in which he introduced the absorbing liquid and the absorbable gas. This bell was connected with a manometer by a tube of india-rubber, and after the establishment of the required pressure was separated from the manometer and shaken by the observer a long time, so as to produce the total absorption. This construction has two great imperfections—firstly, a pressure of more than three atmospheres forces the joint, and, secondly, the long contact of the hands of the observer with the vessel containing the gas, makes the temperature of the gaseous volume very uncertain, both before and after the absorption.

Saussure repeated the experiments of Dr. Henry without changing considerably his apparatus, and came naturally to the same result.

Nearly forty years after the experiments of Dr. Henry, M. Bunsen, of Heidelberg, made a valuable series of experiments on absorption of gases at different temperatures; but the ingenious apparatus he invented for this purpose could only be employed under the ordinary pressure of one atmosphere, and left untouched the relation established by Dr. Henry and Dalton between absorption and pressure. More recently, Messrs. Roscoe, Dittmar, and Simms have made very interesting investigations on the absorption of the gases of hydrochloric acid, ammonia, and sulphurous acid; they proved the law of Henry and Dalton to be only exact at an elevated temperature—viz., 40° Centig. for the sulphurous acid gas and 100° for the ammoniacal gas. For this reason my friend Mr. Longuimine and I resolved to undertake a new series of experiments on gases not so absorbable as those investigated by Messrs. Roscoe, Ditmar, and Simms.

Before all it was necessary to construct an apparatus which should not be liable to the above-mentioned imperfections of the apparatus of our celebrated predecessor, Dr. Henry. It was evident that it must consist of a glass vessel exactly gauged and arranged in a manner to be easily put in connection with a large manometer, and separated from it in a very short time. Secondly, the absorption must be produced, not by shaking the apparatus with the hands, but by moving it mechanically in a space with an invariable temperature.

The first question was easily solved by an iron tube with a cork, and the second by the observation that the contact of the absorbing liquid and the absorbable gas would be very perfect, by revolving the glass vessel containing the liquid and the gas in a great mass of water maintained constantly at the same temperature. These are the two principal differences between our apparatus and those of our predecessors, and without entering into more details on our experimentation executed at the College of France, in the laboratory of M. Regnault, and published in the last number of the *Annales de ph. et de ch.*, I pass directly to the results we obtained for the carbonic acid gas at the temperature of 15°.

If we designate by L, the co-efficient of absorption of a given gas under the pressure of P, and by L2 the co-efficient of the same kind, but under a higher pressure P2, by the law of Henry and Dalton we must have,

$$L_2 : d = P_2 : P_1, \text{ or } \frac{L_2 - P_2}{L_1 \; P_1} = 0$$

But not only are these differences never *nil*, but they are constantly increasing with the pressure, so that this discrepancy with the law mentioned cannot be ascribed exclusively to the inevitable errors of observations.

From the moment that carbonic acid gas was liquefied it was evident that the co-efficient of its absorption by liquids must be *nil* for two different pressures, *first* for a pressure *nil*, or nearly *nil*, and second, for the pressure which reduced the gas at a given temperature to a liquid state.

It was evident also that the expression of a relation between the co-efficient of absorption and the pressure could not be a lineal function of this variable, but that this co-efficient α could be nearer expressed by the equation:

$$\alpha = A + BP + CP_2$$

For $\alpha = 0$,—the equation $A + BP + CP_2 = 0$ must have two positive and real roots, and also $\alpha = A \times BP - CP_2$ and $B \nmid A$, and $C \nmid B$. Applying to this equation for the different values of α and P, obtained by our experiments, the method of least squares, we found for A, B, and C, the following values:

$$A = \pm 0{\cdot}01520946$$
$$B = \pm 0{\cdot}01393995$$
$$C = \pm 0{\cdot}00283004$$

The values being put in the equation $\alpha = 0$ gives us the two numerical expressions of P, which renders $\alpha = 0$, namely,

Atmos.
P = 010983 and P = 61 at 1439

The first of these two values is manifest, and requires no special commentary, but the second merits close investigation.

Our observations were made at the temperature of 15° Cent., and we have no direct experiment on the pressure necessary to coerce carbonic acid gas to a liquid at this temperature; but taking the observations of M. Regnault on the point of ebullition of the liquefied carbonic acid gas at different temperatures we obtain the following table:—

Temperature.	Pressure in Atmos.
73°3	1·8
56·7	5·3
40·0	11·3
28·9	16·3
12·2	26·8
1·1	37·2

so that the pressure increases for every degree of the Centigrade thermometer

In the first interval of	16°1 by 0 at	2,108
In the second ,,	of 16°7 by 0 at	3,473
In the third ,,	of 11°1 by 0 at	4,684
In the fourth ,,	of 17°7 by 0 at	6,287
And in the fifth ,,	of 11°1 by 0 at	9,369

so that without supposing that our last value of P = 61 at 1,439 is exact; but admitting only that for the interval of 16°1 coming next after 1°1, the increase follows the same law, this increase must be for every degree of the thermometer of 1 at 4,845.

But this value multiplied by 161 gives 23 at 23·9 + 76·2 = 61·1.

More importance than they deserve must not be attached to these numerical results, which cannot be strictly exact, being deduced from a too limited series of experiments.

I have mentioned them only to show that our method of experimentation can give us in a comparatively easy way— 1st. The value of pressure required for liquefaction of gases; and, 2nd. The numerical value of the maximum of absorption varying only with the nature of the gas and with the temperature.

EXPERIMENTS WITH NITROGLYCERINE.

By C. A. RICHTER, of Freiberg.*

The following is an account of the results of a comparison of the effects of nitroglycerine and the nitrate of soda gunpowder, which is used in this neighbourhood.

The first experiment was made under the guidance of one of the inventor's agents in the year 1865.

Beihilf shaft, which was being sunk 30ft. long by 8ft. wide, was chosen as a suitable place for the experiments.

* "Berg-und hüttenmännische Zeitung," 1867.

The shaft was being sunk in the "country" (*i.e.*, not on the vein), which consisted of hard grey gneiss, now and then only it had a few joints, which rendered the work easier. This happened to be the case on the day of the above-mentioned experiments, and partly explains the extraordinary effect produced by the nitroglycerine. The effect was indeed extraordinary, because boreholes, placed so as to give them twice as much to do as usual, and even more, did their work perfectly, and, indeed, more than sufficiently, for they caused such an accumulation of stuff in the shaft that for three days no more boring could be done, and the men had to devote themselves entirely to winding up the stuff. The holes were bored partly single-handed, and then one inch in diameter and 27 to 30 inches deep, partly by two men, and then two inches in diameter and 36 to 48 inches deep. The holes were charged in the mode originally adopted by the agent. As all the holes looked downwards, the nitroglycerine could be poured in by means of a tin funnel. Upon the top of it a small wooden cartridge, three inches long, containing a little powder, was let down by means of the Bickford's fuse to which it was attached, and then the hole was filled up by hand, without using any tool at all, first with mud and then with sand or small stuff.

It appeared from these first experiments with nitroglycerine that, without any exaggeration, its power was four or five times greater than that of the powder hitherto in use. From this it naturally followed, as the advantages of a powerful explosive material would be most felt in large workings in close little-jointed rocks, such as sinking a shaft in the "country," that such workings could be carried on much faster than had previously been the case. This advantage which nitroglycerine afforded could only be looked upon as most important.

Besides, other advantages were apparent, which, it is true, did not seem so great as the first, but which, nevertheless, promised to exercise a decidedly favourable influence on the economy of mining. They may be summed up as follows:—

1. Fewer men are wanted for working out a certain sized piece of ground, and fewer holes have to be bored than at present. A dearth of miners may to a certain extent be remedied in this manner, and less steel and iron will be used than hitherto.

2. Nitroglycerine does not take fire easily, and when lighted burns but does not explode, and goes out as soon as the flame with which it had been brought in contact is taken away.

3. The holes can be tamped easily, quickly, and without danger.

4. The amount of smoke after a blast is small compared with that of powder, and workmen can go back at once to the place where they have blasted without trouble. This is a considerable advantage in places where there is but little draught, and holes can be bored and fired singly, which was hitherto almost impossible in consequence of the all but impenetrable smoke, and had to be avoided as much as possible.

5. Holes that have missed or only partly torn can be retamped and shot off, which, with the present arrangements is either impossible or accompanied by great danger.

Against these advantages must be set the following disadvantages:—

a. The gases formed during the explosion of the nitroglycerine have an injurious effect on the organs of sight and respiration.

b. Nitroglycerine explodes on being struck smartly, and easily freezes.

c. The masses of rock which it removes are mostly very large, and considerable time has to be spent in breaking them up.

With regard to the first of these disadvantages, it should be remarked that during the first day's experiments, scarcely any signs of pain in the eyes or head were remarked, although the bottom of the shaft was not particularly well ventilated; later they grew more and more marked, so that it became gradually more apparent that where nitroglycerine was used every effort should be made to secure good ventilation. In the course of time, however, the workmen seem to have become accustomed to the smell, and this disadvantage of the nitroglycerine was no longer looked upon as one which need restrict its employment.

The dangerous property of nitroglycerine of exploding from a smart blow cannot be denied, but this is not more dangerous than the property of ordinary gunpowder of taking fire readily and exploding; and again, the fact of its freezing must be looked upon rather as an inconvenience than a danger.

We must allow that the last of the three disadvantages also exists; holes blasted with nitroglycerine throw down large masses rather than small. These may easily be broken up with a sledge, or, if necessary, be blasted. At all events, it is no greater disadvantage than what happens so often with powder; the rock is blown into small pieces, which are sometimes thrown to a great distance, and may perhaps do damage, not only to the workings but also to the miners. On the contrary, it would seem to be rather an advantage than a disadvantage that the rock should be thrown down gently and without danger, because the workmen, the timbering, and masonry are not so liable to be injured as in blasting with powder.

All the results of the first trials with nitroglycerine were so favourable, that they naturally instigated us to obtain further and more certain proofs of the possibility of practically employing nitroglycerine underground. A comparative experiment was made between the nitrate of soda powder in use here and nitroglycerine at Segen Gottes mine, in sinking a shaft, in driving a level, and in stopes. The nitroglycerine was tried first; 226 holes were bored, in all 5,043 inches (English) deep. Of these holes, 180, or 80 per cent, tore perfectly, 40, or 17 per cent, only half, whilst 6, or 3 per cent, did nothing. 9·302 cubic fathoms (English) of ground were removed; the smith's cost was £1 6s.; blasting materials cost 17s. 1½d.; nitroglycerine, £11 11s. 6d.; wages, £23 12s. 9d.; so that the cubic fathom cost £4 0s. 4d.; the end, on account of its small dimensions, costing comparatively the most, and the sinking of the shaft, for the opposite reason, being the cheapest work. The experiment with the nitrate of soda powder was then made; 559 holes were bored, in all 9,249 inches deep, or 333 holes, with a depth of 4,206 inches more than in the previous experiment. 315, or 57 per cent, tore perfectly; 225, or 40 per cent, only half; and 19, or 3 per cent, not at all. By means of these holes, 6·036 cubic fathoms of ground were removed, in which the end and the stopes do not stand anything nearly so far behind as in the first case. The smith's cost was £1 18s. 2d.; blasting materials, 9s. 7d.; powder, £3 13s.; wages, £24 7s. 10½d.; so that the cubic fathom cost £5 0s. 9¾d. With powder, therefore, 3·266 cubic fathoms less ground were removed, though the wages (in spite of one case of loss of wages) were 15s. 1½d., and the smith's cost 12s. 2d. more; on the other hand, on account of using the needle in blasting, the blasting materials cost 7s. 6½d. less; the powder also cost £7 18s. 6d. less than the nitroglycerine. Taking all together, the cubic fathom with powder cost £1 0s. 5¾d. more than it did with nitroglycerine.

These experiments show that the employment of nitroglycerine, especially in large workings, already offers great advantages over ordinary powder, and that these advantages lie in the fact that with fewer holes, and in a shorter time, a greater amount of ground can be removed than by the present mode of proceeding. Besides, in working out any given quantity of ground nitroglycerine is found to do the work much cheaper, on account of the extraordinary force with which it blasts the holes, and the smaller quantity of iron and steel used up. Lastly, the holes can be tamped much quicker and without danger, as if they are loosely filled with sand, any

small stuff, or even water, they can be considered as thoroughly well tamped. But even a stronger tamping, such as is in use in the Hartz, has, up to the present time, been entirely exempt from danger, and has doubtless caused a greater effect, under certain circumstances, as may be readily understood. In the Hartz, the cartridges, made of well-glued paper, are filled with sand in order to make them stiffer, and especially to allow their being longer, and thus to spread the explosive force over a greater area; in other words, to give the explosive force a greater leverage, and thus increase the effect. The proper quantity of nitroglycerine for each hole is then poured into the cartridge by means of a little can with a spout, until the sand is more than saturated, and the whole of the nitroglycerine forms one single mass; on the top a little sand is put so as to close the cartridges better, and then the upper part is pinched up just as in the cartridges filled with powder. Where nitroglycerine is used alone, without sand, the cartridges are made long and narrow for the reason explained above; they are closed with a cork. The cartridge in either case is carefully let down into the hole, or pushed in with the tamping bar, or scraper. Upon the top of it comes a paper cartridge, about two or three inches in length, not particularly strong, and filled with good powder, such as sporting powder: it has the ordinary iron needle stuck in it, but without the reed; a little clay is stuck on the top of the cartridge and round about the needle. The tamping employed is clay-slate beaten up fine, and made into a soft mass with water; this is moulded into lumps like pieces of peat, and when dried is ready for use. This tamping is forced in with the iron tamping bar, the wooden one being discarded; the first blows are gentle, and then gradually harder and harder until the mass rings. The hammer, however, is not used, the tamping is simply rammed in with the iron bar. When the hole is tamped it is clayed over, the needle drawn out, and instead of the reed filled with powder, a paper fuse is stuck in and the hole fired off.

The results obtained by the experiments described above would probably have been greater had the workmen been as thoroughly accustomed to the use of nitroglycerine as they are to that of powder. This may be inferred from the fact that far fewer holes were bored in the experiments where nitroglycerine was used than in those where powder was the blasting material employed. For though it must be conceded that holes blasted with nitroglycerine brought about more delay, and caused more time to be spent in winding stuff, and thus caused a loss of time, still the difference in the number of holes bored is so great that we may assume that the men would have bored more holes if they had had more experience in the mode of procedure adopted with nitroglycerine.

The same thing no doubt happened when gunpowder was first introduced, and probably less work could be done with it, and much more danger accompanied its employment, than has since proved to be the case.

In speaking of the many advantages which, according to these experiments, nitroglycerine possesses over gunpowder, it may be added that still further progress has been made with regard to its introduction, and people have not been stopped even by two accidents which have occurred from using it. In one case walls to keep up the attle heap were being built out of some large pieces of rock brought up from the Beihlif shaft, and which had been lying out in the air for some time. These pieces had to be trimmed a little with the hammer, and during this work a small explosion occurred, slightly injuring the mason in the eye.

The explosion was probably caused by some nitroglycerine which had escaped decomposition and remained sticking to the rock. In the second case a hole in the mine did not tear the rock properly but simply split and loosened it. As the miner was removing these loose pieces an explosion occurred from undecomposed nitroglycerine which remained in the cracks. Luckily, the man was but slightly injured.

The accidents can only have occured from the nitroglycerine having been used alone without any cartridge, or from the hole not having been properly clayed, so that the nitroglycerine found means of getting into joints and cracks and escaped decomposition. The consequence has been that nitroglycerine is not so often poured straight into the hole, but is enclosed in a cartridge of paper well joined with glue, and in order to give the cartridges greater strength, and the explosive material a greater area to act on, the cartridge is first of all filled up to a certain height with sand, or, as I have since tried, it is at once filled with common powder.

Now, although it has been remarked that a hole containing free nitroglycerine does more work than one in which the blasting oil is contained in a cartridge, which somewhat hinders the quickness of its decomposition, it must not be assumed that the real reason has yet been hit upon, and before a final decision further evidence must first of all be obtained.

Further experiments were made in the above-described manner in sinking a shaft in clay-slate. During a period of three months the men were paid for having worked 372 shifts, £13 15s. 9½d., or, adding in the money paid for extra work, £2 10 0¾d., altogether £16 5s. 10½d. 251 holes, with a total depth of 7,520 inches, were bored, and 11·972 cubic fathoms of ground were removed. Of these holes 229, or 91·2 per cent, tore perfectly; 18, or 7·2 per cent, only half; and 4, or 1·6 per cent, simply blew out, but could be used again on being recharged. In each shift, then, ·67 of a hole, or 20·2 inches were bored, and ·0321 of a cubic fathom of ground removed, which cost 9d., or, including the extra wages, 10½d. The smith's cost was 9s. 4d.; blasting materials, 16s. 5d., and the expense of 99·67 pounds of nitroglycerine £17 18s. 9¾d.; so that the total expenditure was £35 10s. 5d., or £2 19s. 3½d. per cubic fathom.

The results of these experiments are still more favourable than those obtained previously, and the reason of this lies in the fact that the experiments were confined to a shaft which was being sunk of greater length and breadth than the previous one, and consequently, the full effect of the nitroglycerine was obtained. The sinking of the shaft in question has been consequently continued with the aid of nitroglycerine, and with excellent results, for the holes do quite three times as much work as they did with gunpowder. The sinking of course proceeds more rapidly; the complaints about headaches caused by the nitroglycerine have ceased, and no other inconveniences have manifested themselves. It must not be denied that this favourable result is partly owing to the length and breadth of the shaft, the tight nature of the ground, as well as to the porous nature of the clay-slate, and the wetness of the sinking. Still some means should be discovered to lessen or prevent entirely the injurious effect which nitroglycerine has on the health of the workman. If further experience does not bring any other disagreeable qualities to light, there is no doubt that nitroglycerine will be more generally introduced in certain workings to which it is specially adapted, and then further improvements may bring about still more important results than those which have already been obtained in certain cases.

Sulphite of Uranid, Double-salts of.—L. Scheller. Pure oxide of uranid (uranid = U'''' = 240) prepared according to Malaguti's method by heating an alcoholic solution of uranic nitrate and washing the residue, was suspended in water, and sulphurous acid gas passed through until all was dissolved. On adding to this solution potassic, sodic, or ammonic disulphite, crystalline precipitates are obtained of the following compositions:—UK.HSO_6, UNa,HSO_6, and $UNH_4.HSO_6$. They are difficultly soluble in water, but dissolve readily in sulphurous acid.—(*Zeitschr. Chem.* N.F. iii. 522.)

ON THE DEVELOPMENT OF IDEAS IN NATURAL PHILOSOPHY. *

By JUSTUS VON LIEBIG.

The history of natural philosophy teaches us that the final object of our knowledge of matter and phenomena is the material and intellectual requirements of mankind.

Nature has denied to man the means of resistance against external injurious effects which constantly endanger his existence; and it is in the first place the pressure acting upon him from without, which challenges his dormant mental powers to a combat. He gains from nature whatever he requires for the purpose, as a protection against the influence of climate and against his enemies, as a means of supporting life or restoring health, and thus originates the acquaintance with innumerable substances, and their qualities, and with the processes by which they are made suitable to his purposes. In a former lecture I took occasion to draw attention to the peculiar power of the imagination to call forth the relationship between different pictures raised by impressions upon our senses, and to draw inferences, which depend upon each other in a similar manner as the ideas which guide the understanding in its combinations, only with this difference, that the inferences of imagination are likewise pictures. A word taken as the sign of an idea is the same to the understanding, as an impression upon the senses to the imagination.

The word "tar" is very likely without the slightest reaction upon the imagination of most people, whereas the smell of ship's tar will awaken in the imagination of an individual the picture of a ship or a sea-port visited by him years ago.

The husbandman, the shepherd, the hunter, stand in direct communication with nature. The first learns by simple observation of the senses, how sunshine and rain act upon the growth of his plants, how the seed germinates and developes itself into a plant, how the latter blossoms and bears fruit; in the same manner the shepherd collects a mass of experience on the maintenance and propagation of the animals he tends, he becomes acquainted with their diseases, and through them with nutritive and venomous plants, he constructs himself a timepiece on the starry sky, he learns to know the course of the heavenly bodies and how they move with the seasons. The priest who dissects the animals of sacrifice learns to know their internal parts and their relative functions. A collection of such facts leads those who observe them to draw inferences about the existence of other facts. The shepherd searches for medical herbs for his animals, and applies them to man; from the changes produced by diseases in the organism of animals, the sacrificer draws inferences as to the nature of human diseases. Thus the shepherd becomes the first therapeutist, the priest the first pathologist.

The processes of manufacturing leather, soap, glass, wine, oil, bread, and cheese have been invented by deductions of a similar nature; they are very ancient, as are also the application of woollen and vegetable fibre to textiles, the art of dyeing, smelting of copper, tin and iron ores, the extraction of gold and silver.

The superiority of man over other animals chiefly depends upon his capacity to produce inventions which meet his requirements, and the sum total of these inventions in a population expresses the meaning of its civilisation. By means of the inventions of men in art and manufacture, in medicine, mechanics, and astronomy, those facts are acquired which are indispensable to the subsequent development of science; they lead to the knowledge of the phenomena of motion in the firmament and upon the surface of the globe, of the constituent parts of the earth and of the animals and plants on the same; they lead to the discovery of the effects of fire and of the natural forces,—but the experimental science which leads to inventions, does not seek any solution of the nature and essence of matter and natural phenomena, for this is quite beyond its range. The scientific study of nature aims at different results; it springs from the intellectual requirements of man, from the impulse of his mind to account for the world in which he lives, and for the objects and phenomena which daily engage his senses.

Now, at the commencement of this inquiry, man does not know anything of the nature of his senses: not that the origin of things is inaccessible to them; the senses, intended to assist him in comprehending the outer world, are to him implements the handling of which he does not know; he sees and hears, but he knows nothing of light or sound, he does not know whether he looks with his eyes at certain objects or whether these objects look into his eyes, nor that the temperature he feels is his own.

History teaches us that the popular notions of substances and events in the outer world develope themselves much in the same way as the mind of a child, which becomes acquainted only gradually with the impressions of his senses. By continued and repeated testing things with the hand, the eye, or the tongue, the child learns to recognise and distinguish their shape, colour, and condition, the resistance offered, solid from the liquid, the cold from the warm, the dry from the wet; and the child's further development chiefly depends on his capacity to reproduce within himself the already observed without calling in further assistance of his senses. The pictures retained by memory gradually increase in number, and the human mind begins unconsciously to put questions to the senses; it compares and discovers analogies and distinctions; it notices that under certain conditions cold becomes warm, liquid solid, solid liquid; but a long time elapses before it learns the characteristics of every substance, The idea of motion connects itself with a hand which lifts, pushes away, or draws something towards itself.

With ideas of this kind the investigation of nature began, and its further expansion took place as in an individual, only the senses and minds of many participated in testing matter and in considering processes; every man takes his own point of view, every one observes in the object or phenomenon a different face and profile, and thus it gradually becomes known from all sides; later on, when the details become more distinct, many phenomena are found to have parts, to be compounds, and things are discovered to be present which escaped the simple observation of the senses, our former trust in the impressions of the senses is lost, and measures are adopted to prove their veracity.

In this manner we gradually succeed in acquiring of matter and of processes definite ideas which are applicable to mental operations; with their accumulation the number of their combinations naturally increases, as also the mastery of the mind over the senses;—instead of unconscious questions he now asks positive ones, instead of one a number of questions, the perceptions grow into conscious observations.

No one will maintain that in former times an obstacle had existed in the senses of men preventing them from seeing and perceiving everything in the same manner as we now see and perceive. Want of facts is also not the reason of the difference in our recent and former views of many phenomena; true, we now know more facts than formerly, but those relating to the most common phenomena—to air and fire, vapour and rain, heat and cold—were just as well known and observable to men a thousand years ago as they are to-day, and no one will imagine that before the discovery of oxygen people were the least doubtful as to the necessary presence of air for burning and respiration, or of a strong current of

* A Lecture delivered at the Meeting of the Royal Academy of Science, at Munich.

air for the production of high degrees of heat. Our better understanding does not lie in our senses nor in our higher mental capacity, for in regard to the latter the great philosophers of antiquity who endeavoured to gain information on the essence of matter and phenomena serve still at the present day as models unsurpassed.

The true reason is that we have grown richer in ideas; but the ideas of things, or, what is the same, the acquaintance with sense-observed things, their peculiarities and agencies, man does not bring into the world with him; they must be acquired by experience, must be developed in his mind in a totally different manner from the animal, whose faculties are developed to the highest perfection attainable without his co-operation, in consequence of natural laws acting within him.

All these conceptions originated with or sprang from impressions of the senses, and as natural phenomena are always composite, and their conditions or parts are again things which likewise produce definite and invariable impressions of their own, it is clear that a mental conception of a thing or phenomenon must include all these characteristics in itself.

We speak of carbon as a constituent part of plants and animal bodies, without calling to our mind either diamond, coal, charcoal, or lamp-black; the same with phosphorus or iodine, which as such do not even exist in nature. These are all abstract notions which once settled, raise in all cases where their characteristics are perceived, the idea of carbon, phosphorus, or iodine.

The natural phenomena are linked together like the meshes of a net, and the investigation of individual phenomena results in showing that they have in common certain conditions, which as stated above are active realities; and as the totality of the conditions or parts of all phenomena is limited and relatively small, we succeed at last in reducing all natural phenomena to conceptions.

This is the problem of science,—its progress depends upon the accumulation of facts, but it is not in proportion to their number, only to the sum total of mental material deduced from the facts. A thousand facts *per se* do not alter the position of science, whereas a single one which has become comprehensible outweighs in course of time all others in importance.

These views of the development of the ideas derived from experience, or, to use a shorter expression hereafter, of *derived ideas*, may perhaps assist in leading to a more correct estimate of the different epochs in the comprehension of natural phenomena than has hitherto been the case.

The explanation of a natural phenomenon being a logical, process, our intellect is *à priori* enabled to lay down the proposition, *i.e.* the logical conditions, which must combine in its comprehension or explanation. This has been done by Aristotle, who says the road of philosophy is that of all other sciences—"One must first collect the facts, and then learn to know the things on which the facts originate; not the mass of facts all at once, but every one must be viewed singly and separately, and the inferences drawn from it; as soon as we have the facts it becomes our business to settle their combination.

"These facts are acquired by observations of the senses; if these latter are imperfect, the knowledge depending upon them will be so likewise."

"We cannot have any general theoretical propositions unless by induction, and induction can be made only by perceptions of our senses, for these have to deal with the individual."

These are the chief principles of investigation bequeathed to us by the great philosopher of antiquity, and they have still the same import which they had two thousand years ago.

On studying his explanations of natural phenomena and those of the whole successive series of natural philosophers, down to our own time, we find that at all times the opinion obtained, that the conceptions were in harmony with the facts, and indeed the definitions always corresponded with the logical laws, but the later are always in opposition to the earlier; what had been held to be right is found to be wrong at a later period, and thus the subsequent definitions annul the former ones, and this goes on for centuries, hence it becomes evident that the truth of the definitions does not depend upon the principles of logic alone.

But if we consider, on the other hand the derived ideas of Aristotle and subsequent investigators, we find at once the reason why the most highly developed intellect and the keenest logic of themselves, do not suffice for a correct explanation, because this depends entirely upon the extent of the derived ideas.

At the beginning the facts which an idea includes are undefined, and their number and extent is unknown; hence it follows, *eo ipso*, that the first explanations cannot be defined or exhaustive, and that they must change in the same proportion as the facts become better ascertained, and the unknown facts, being part of the ideas, are discovered and are embodied in the idea; the earlier definitions therefore are only comparatively wrong, and the latter are more correct merely because the extent of the idea of things has become larger, clearer, and more definite. This development takes place in a certain succession.

No subsequently developed idea can precede in order of time an earlier one, and if it is ineffective, this happens because it is wanting in extent. With the earlier idea the development of all subsequent ones is bound up.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, November 7.

WARREN DE LA RUE, Ph.D., F.R.S., President, in the Chair.

At this, the first meeting after the summer recess, there was an unusually large attendance of Fellows, and a full programme of interesting matter was provided. The proceedings were opened as usual by reading the minutes of the last meeting, and announcing the contributions to the Society's library. Mr. Henry Dircks, C.E., was formally admitted a Fellow of the Society, and the name of Charles Meymott Tidy, M.B., of the Hollies, Cambridge Heath, Hackney, was read for the second time. The names of the following candidates were proposed for election:—Thomas Hall, B.A., Lond., Lecturer on Chemistry and Natural Philosophy at the City of London School; Charles Walter Maybury, Teacher of Chemistry, 90, King Street, Manchester; George Lunge, Ph.D. (Breslau), 10, Albert Terrace, South Shields; Facundo J. R. Carulla, Chemist to the Atlas Steel and Iron Works, 59, Gell Street, Sheffield; and Alexander Crum Brown, M.D., Lecturer on Chemistry, 4, Rillbank Terrace, Edinburgh.

The PRESIDENT stated that the Council had appointed a sub-committee to consider and report upon the mode of election of Fellows into the Society, and to canvas the opinion of the members as to the qualifications necessary for the attainment of the honorary distinction which the Society has it in its power to confer. A great number of

replies had been received in answer to the circular which the Secretary issued in June last, and the committee would at an early date be prepared to advise the general body of members of the results of their enquiry.

The President further stated that a melancholy event had occurred since the last meeting in the death of Professor Faraday. Several of the Fellows shared his own feelings in this matter, and considered that the sad occasion demanded a special notice on the part of the Society, of which the deceased was one of the earliest and most distinguished members. It was now proposed to present an address of condolence to the widow, framed in the following terms :—

"Resolution—That the Fellows of the Chemical Society request their President to convey to Mrs. Faraday their deep sense of the loss which science has sustained in the death of her highly distinguished and much esteemed husband, and that they beg respectfully to express their heartfelt sympathy with her in this great loss."

Mr. W. H. Perkin was then invited to read a paper "*On the Action of Acetic Anhydride upon the Hydrides of Salicyl, Ethyl Salicyl, &c.*" The author endeavoured to obtain the hydride of aceto-salicyl by acting upon the hydride of salicyl with acetic anhydride, but the expected reaction did not take place. There resulted from the direct union of these bodies a white crystalline substance, fusible at 103°—104°C., and insoluble in water. An analysis of this compound led to the formula—

$$C_{11}H_{12}O_5 = C_7H_6O_2,\ C_4H_6O_3.$$

By a similar action between the same anhydride and the hydride of ethyl salicyl a body crystallising in small brilliant, transparent prisms was formed, which fused at about 89° C. Its composition was—

$$C_{13}H_{16}O_5 = C_9H_{10}O_2,\ C_4H_6O_3.$$

The methyl salicyl compound was easily formed. Its fusion point was 75° C.

The author has likewise investigated the corresponding compounds in the benzoyl series, and arrived at results in general accordance with the previous statements of MM. Geuther, Hübner, and others; but the author does not accede to the view expressed by the latter, which asserts that the body produced by the action of acetic anhydride upon the hydride of benzoyl is identical with the diacetate of benzoyl of M. Neubauer. On the other hand, this class of compounds, like those of the preceding series, are but further examples of the same kind as the compound of acetic anhydride and ordinary aldehyde discovered by Geuther; and not identical, but only isomeric with the acetate of ethylene of Wurtz.

After a few words of explanation had been given in reply to Dr. Odling's inquiry as to what was intended by an expression made use of in the concluding paragraph of the author's paper, to the effect that "the phenolic properties disappear," the President invited Mr. Chapman to give an account of the "*Nitrous and Nitric Ethers*," samples of which were upon the table.

The authors, Messrs. Chapman and Smith, commence with a detailed account of the methods adopted by them in the preparation of the nitrites and nitrates of amyl ethyl, and methyl, and in the second place describe a considerable number of reactions and decompositions which the ethers in question undergo on treatment with metals, acids, and sundry chemical reagents in a digestion apparatus. The most remarkable feature of the authors' communication appeared to consist in an easy mode of preparing the nitrate of amyl in large quantities. This was shortly as follows :—Nitric acid of specific gravity 1·36 was mixed with twice its bulk of oil of vitriol, and allowed to cool; of this mixture 150 c.c. was placed in a beaker surrounded by iced water, to which is added a little salt to reduce the temperature one or two degrees below zero. 50 c.c. of amylic alcohol were now gradually added from a small dropping funnel the limb of which reached nearly to the bottom of the mixed acids, and kept constantly stirred by the motion of the funnel itself, six or eight minutes being occupied in this process of admixture. No apparent action takes place beyond the production of an oily layer upon the surface of the mixed acids, which is removed by means of a separating funnel and washed in three or four changes of water. 100 parts of amylic alcohol yield by this process within five per cent of the theoretical quantity, or about 144 parts of the nitrate of amyle instead of 151. After rectification over chloride of calcium a colourless liquid is procured, which boils at 147°—148° C., and at the temperature of 7° or 8° C. has the same gravity as water. Hence there is an advantage in using warm water for the purification of the crude acid product. The inhalation of the vapour of this substance is to be guarded against, for it invariably produces headache and other distressing symptoms. The general result of the author's investigation is to show the great stability of the nitric ethers and the extraordinary chemical mobility of the nitrous ethers; bodies of the latter class are not, however, to be considered as unstable, since they exhibit no tendency to spontaneous decomposition.

The President, in moving a vote of thanks to the authors, referred to the interest attaching to the ready means of preparation which had been described. There was another light in which these investigations would prove valuable; namely, by pointing out facilities for obtaining some of the secondary products by simple reactions.

Mr. Robert Warington, jun., then gave an abstract of an exhaustive agricultural research undertaken for the purpose of determining "*the Part taken by Oxide of Iron and Alumina in the Absorptive Action of Soils.*" Experimenting with the artificially prepared hydrates of alumina and ferric oxide, as well as with two samples of native soil containing widely different amounts of the same ingredient (or rather, "oxide of iron and alumina" 6·82 and 19·31 per cent respectively), the author tried the effects of passing solutions of tricalcic phosphate, alkaline carbonates and sulphates, ammonium salts, &c., through them for the purpose of ascertaining the rate and extent of absorption. Inasmuch as the calcareous constituents in the natural soils would have interfered with the actions which it was now intended to observe, these matters were first removed by digesting in weak acetic acid and thoroughly washing with water. The soil thus purified was left for several days in contact with a carbonic aqueous solution of the tricalcic phosphate, a current of carbonic acid gas being occasionally passed, and after the lapse of a week the ferruginous soil was found to have withdrawn 93·8 per cent of the phosphoric acid originally present in the solution and only 49 per cent of the lime, hence the author believes that the ferric oxide and alumina may be considered to possess a special affinity for this mineral acid, and that all the phosphoric acid applied to land in the shape of manure must ultimately become converted into the phosphates of these bases. If the amount of iron be sufficiently large, all the phosphoric acid will be retained by preference in the form of ferric phosphate. The absorption power of soils for potassium salts was found to be much greater in the instances of the phosphate, sulphate, and carbonate, than with either the chloride or nitrate. The corresponding ammonium salts

behaved in a similar manner. The author deduces from his experiments a general conclusion to the effect that the absorptive action of soils, for the constituents named, is dependent upon true chemical affinities, in contradistinction to the view which asserts it to be a consequence of the exercise of merely physical attractions.

In passing a vote of thanks to Mr. Warington, the President invited the opinions of the eminent agricultural authorities whom he saw in the room; for his own part he should incline to the belief that caustic lime, so largely applied by the farmer, would have a great influence in absorbing the phosphoric acid.

Professor Way conceived there was more difficulty in accurately ascertaining the degree of absorption of the carbonates of ammonia and potash than in the cases of the other alkaline salts named. Mr. Warington concluded that the oxide of iron and alumina absorbed more of these ingredients than did any other constituent naturally occurring in soils, but he would remark that the very existence of hydrate of alumina was at the outset a matter open to question. This earth was generally supposed to occur in the form of a double silicate, and many kinds of clay contained lime locked up in such a manner that it could not be extracted by acids; bodies of this class had the power of absorbing ammonia without any apparent change of a chemical character.

Dr. Völcker said his experimental results were mainly in accordance with the conclusions stated by Mr. Warington. He likewise had noticed the powerful absorption of phosphoric acid, and, in a less degree, potash and ammonia by ferruginous soils. There was a kind of ferric oxide precipitated by lime, which behaved in an extraordinary manner as to the amount of phosphoric acid it could take up, and lime in a soil has great influence in absorbing ammonia. So also has hydrated silica, although the artificial preparation is in this respect much inferior to the silicates naturally occurring in soils; and, again, there were other additional constituents of which no account had been taken. There was a remarkable tendency in nature for "the soil to take care of itself," and if there should happen to be a deficiency of any one ingredient this was quickly remedied by prior selection from out of a mixture of materials presented in the form of manure; thus the affinities were regulated by bulk, and the land seemed to avail itself of those constituents of which it stood most in need, and the double silicates were in this respect pre-eminently fitted to absorb ammonia, &c., as was first pointed out by Professor Way.

Dr. Gilbert said that many years ago Mr. Ronalds and himself pursued a somewhat similar line of research, and although he was not prepared to endorse all that Mr. Warington had advanced, his paper possessed merit inasmuch as it established certain points; but there was a question as to the applicability of these results to soils as they really exist. The speaker agreed with Dr. Volcker in believing that soils have almost an instinct to guide them as to what they should or ought to do.

Mr. Warington briefly replied by asserting that when the soil contains lime in addition to the ferric oxide these bases act more freely but in the same direction. With regard to the absorption of phosphoric acid by a ferruginous soil it was only a matter of time as to how large a proportion was combined; humus appeared to be capable of absorbing free ammonia, and so it must be admitted that each constituent will require to be studied singly.

"*Analysis of the Water of the Holy Well, a Medicinal Spring at Humphrey Head, North Lancashire,*" by Thomas E. Thorpe, Dalton Scholar in the Laboratory of Owen's College, Manchester. This paper was read by the Secretary, and described the composition of a brackish water issuing from the rocks on the northern shore of Morecombe Bay. Its specific gravity is 1005·8, and constant temperature 11·5° C. The results are stated both in grammes per litre and grains per gallon, the latter column only is here quoted.

	Grs. per Gallon.
Barium sulphate	0·0329
Strontium sulphate	0·2912
Calcium sulphate	88·4898
Potassium sulphate	9·1749
Sodium sulphate	24·3971
Magnesium bromide	0·0294
Magnesium iodide	traces
Lithium chloride	0·1414
Sodium chloride	331·7524
Ammonium chloride	0·0231
Magnesium chloride	43·4882
Calcium phosphate	0·0266
Calcium fluoride	traces
Calcium carbonate	9·2029
Ferrous carbonate	·2191
Manganous carbonate	0·0168
Silicic acid	1·2341
Organic matter	traces
	508·5199

A paper entitled "*On the Action of Permanganate of Potash on Urea, Ammonia, and Acetamide in strongly Alkaline Solutions*," by Messrs. J. A. Wanklyn and Arthur Gamgee, was read in abstract by the first-named author. Referring to the anomalous reactions observed on boiling various organic substances with permanganate of potash and excess of alkali, by Chapman and Smith, the authors treated the bodies named in the heading with the same reagents under a variety of circumstances. Amongst others, the following experiments were made—

	I.	II.
Urea artificial	·1 grm.	·1 grm.
Permanganate of potash	1·0 ,,	2·0 ,,
Caustic potash	10·0 ,,	10·0 ,,
Water	10·0 ,,	12·0 ,,

I. Heated in sealed tube for 12 hours at 130° C.
II. Heated for one hour at 160° C.

Results.—In the first experiment rather less than half the nitrogen of the urea appeared as nitrogen gas; about half was oxidised to nitrites or nitrates, and a small portion was found as ammonia. By increasing the permanganate, as in II., there was little or no oxidation; nearly all the nitrogen being liberated in the form of gas. When much weaker solutions were employed, and the materials introduced into a common retort and distilled, there was a slow evolution of ammonia, but the total quantity of nitrogen eliminated in this form, and estimated by Nessler's test, did not amount to one-fourth of that existing in the urea.

Ammonia, similarly treated with liberal amounts of potash and permanganate in pressure tubes, was completely changed into nitrate. The same result, or a nitrate, was observed in operating upon acetamide.

From a consideration of the differences in the behaviour of urea and ammonia, &c., under the action of the permanganate, the authors refuse to accept the common view that urea is carbamide; they prefer to write its formula on the marsh-gas type, thus—

$$C\begin{cases} NH \\ NH_2 \\ OH \end{cases}$$

Professor Wanklyn also read a paper entitled "*Verification of Wanklyn, Chapman, and Smith's Water Analysis on a Series of Artificial Waters.*" The author deemed it desirable to place on record the results of a series of synthetical experiments undertaken for the purpose of testing the accuracy of the method of analysis lately proposed. Fresh albumen (white of egg) was dissolved in water with the aid of a little carbonate of soda, and diluted to make a solution containing one per cent. Various measures of this solution were diluted to half-a-litre with pure water, and submitted to distillation, first with the simple addition of ·5 grm. of carbonate of soda, when it was found that

mere traces only of ammonia passed over in the first 100 c.c. of the distillate. At this stage, caustic potash (about 10 grms.) and permanganate of potash (·5 grm.) were added, and the distillation proceeded with. The total amounts of ammonia thus procured, and estimated by Nessler's test, accorded with the quantities of albumen taken, or at least within the limits of 5 per cent error. The proportion of ammonia obtained is never the total quantity, but always that corresponding to two-thirds of the nitrogen contained in the albumen; and the authors base their calculations on the fact that 1 part of moist white of egg yields ·0121 of ammonia. Seven experiments of this kind were quoted by the author, performed upon quantities of albumen varying between 7 and 41 milligrammes. The estimation of urea by the same method was not nearly so accurate, and when pure materials were employed, no ammonia, or a mere trace only, was evolved; but when the urea occurs along with "albuminoid matter" in a natural water, the surrounding impurities start the action, and enable the operator to obtain much of the ammonia (·37 out of ·46) by long boiling with carbonate of soda. The addition of alkaline permanganate to a known quantity of urea did not induce the evolution of the whole of the nitrogen in the form of ammonia. (See also experiment recorded in the previous communication).

At a late hour a vote of thanks was passed to the authors of the several communications, and the titles of papers in hand were announced. "*On the Pyro-phosphoric Amides*," by Dr. J. H. Gladstone; and "*The Relation between the results of Water Analysis and the Sanatory Value of the Water*," by Mr. E. T. Chapman. The meeting was then adjourned until Thursday, 21st instant.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN.

Wednesday Evening, November 6, 1867.

G. W. Sandford, Esq., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

Several donations to the library and museum were announced, and the thanks of the meeting given to the respective donors.

Dr. Attfield made some remarks on a specimen of farina which had been forwarded by Mr. Palmer.

Mr. Tilden then proceeded to describe a new way of preserving the syrup of iodide of iron. He began by referring to the mode of preparing it, and also to the addition of iron wire, which had not been found to prevent the change it undergoes, after the syrup has been prepared. Diffused light accelerated the action of atmospheric oxygen; but if exposed to direct sunlight it became bleached again. Mr. Tilden had found that it could be preserved from contact with the air by a stratum of oil floating on the surface; but it was necessary to put the oil into the bottle before the syrup, and it was better if kept in a dark place. The syrup might be removed from the bottle by means of a tap.

Dr. Redwood said he believed the introduction of iron wire was originated by Mr. Squire, but it had not been found a satisfactory mode for the preservation of the syrup, for part of the iodine was taken out of the solution through the action the iron exerted. He thought Mr. Tilden's process an ingenious one. When it was first described to him there seemed to be some practical difficulties which Mr. Tilden had taken cognizance of, and had remedied to a great extent.

Dr. Attfield asked Mr. Tilden if the specimens of the syrup had exhibited any acidity. Some years ago Mr. Phillips considered that hydriodic acid was formed through decomposition of water.

Mr. Tilden had not noticed such to be the case.

Dr. Redwood said if it was kept for some time the sugar would undergo a change and become solidified, being converted from cane into grape sugar, and it was quite possible that a little hydriodic acid might occur.

Mr. Hills and Mr. Umney said that by bottling it all off while hot they had found it keep well for six months.

A Member had noticed that by simply immersing the bottle in a water-bath for five minutes the syrup returned to its original colour.

Mr. Barnes had noticed a change in the syrup of phosphate of iron, and enquired if it was necessary to keep it in a dark place.

Dr. Attfield said it was owing to oxidation, and recommended the bottle to be kept well stopped.

Dr. Redwood then read a paper on "*The Adulteration of White Precipitate*," which had been sent by Mr. Borland of Kilmarnock.

The author commenced by alluding to the excellent paper read at the British Pharmaceutical Conference by Mr. Barnes, F.C.S., regretting that he had not stated whether the samples he had examined were fusible or infusible. He then referred to the forms for preparing it in the Pharmacopœias. The infusible would volatilise without fusing at a heat below redness. The form for the fusible was NH_3HgCl, and the infusible NH_2Hg_2Cl. He had examined 24 samples, and only five were made according to the authorised form. The fusible would not make so white an ointment as the infusible.

Mr. Barnes said that three or four of the samples he examined were fusible and the rest were infusible.

The President was very glad to find that it was not adulterated to such an extent as it used to be.

A Member asked Professor Redwood if there was any difference in the value of the two preparations.

Dr. Redwood was not aware that any experiments had been made.

Dr. Attfield did not imagine there would be any difference in their value, the mercury being in the same condition in both preparations.

Dr. Redwood exhibited some moulds which had been sent by Mr. Procter to illustrate his paper "*On Suppositories and Medicated Pessaries*," in the present number of the *Pharmaceutical Journal*, in which he recommended the use of cones made of tinfoil, the usual conical shape being obtained by softening the end of a rod of gutta-percha, or of a stick of sealing-wax, and pressing it into a conical minim measure.

Several members and associates gave the results of their experience in the preparation of suppositories &c., and Dr. Attfield referred to the great merits and the great educational value of Mr. Procter's paper, showing as it did what a large amount of work could be done with simple materials, but he did not think the pessaries made in the way Mr. Procter had described were so neat in appearance as those made in the gun-metal would.

Mr. H. S. Waddington read an highly interesting paper, "*On the Preparation of Microscopic Crystals*," in which he strongly recommended the process of rapid crystallisation. Mr. Waddington has evidently devoted a great deal of time and trouble in preparing processes for the preparation of microscopic crystals, and we regret that he read his paper so quickly, for it contained much that was most interesting and instructive to the microscopist. After the reading of the paper, Dr. Attfield, Professor Redwood, Professor Bentley, and the President spoke in very high terms of Mr. Waddington's paper, and hoped that he would pursue the subject still further.

Mr. Umney postponed the reading of a paper, "*On a New kind of Kamala*" till the next meeting, which was announced to take place on the 4th of December.

FOREIGN SCIENCE.

(From our own Correspondent.)

Paris, Nov. 12, 1867.

Improvements in Automatic Telegraphy.

Since the 11th September, 1867, the Directors of the telegraphic lines have made use, in the service between Paris and Lyons, of a new system of rapid transmission invented by MM. Chaudassaignes and Lambrigot, telegraph clerks. This telegraph acts automatically, transmitting the despatches between the two towns at the rate of 120 or 180 despatches per hour by a single conducting wire, a velocity three times as great as that obtained by other systems, and capable of being augmented proportionately to the diameter of the wire.

The transmissions are made by a band of metallic paper on which the signals composing the despatch are traced in insulating ink. The reproduction is obtained on a band of unsized paper, the centre portion of which is impregnated with a chemical liquor necessary for the formation of the characters existing on the metallic band.

In order to obtain regularity of execution in the different operations, such as the composition, transmission, and reception, they pass through several hands according to the requirements.

One instrument in communication with the line is composed of—1. A clock-work movement. 2. A double roller which sets at work either the metallic or the chemically prepared paper. 3. A ringing apparatus for calling the attention of the correspondent. 4. A "Morse" manipulator of ordinary construction for the exchange of the conventional signs necessary for setting in movement or stopping the rollers.

The clock-work movement is set at work by a weight easily wound up by means of a pedal; it serves to maintain the rollers in movement. Near the roller round which the metallic band passes, is a point which represents the extremity of a conducting wire. The roller communicates with the electric pile. When the band is drawn into movement by the rotation of the roller, the point is placed sometimes on one of the metallic parts of the band, and sometimes on the written parts of the despatch where the isolating ink is, so that the conducting wire marks the message by the alternate passage, and breaking of the current. Near the roller, on which is coiled the unsized paper, is placed a cup filled with a solution of nitrate of ammonia and ferrocyanide of potassium. In the middle of this cup is a small roller which dips into the liquid in its lower portion, and the upper portion of which rises a little higher than the edges of the basin and supports the band of unsized paper which, drawn by the rotation of the two rollers, turns the small dipping roller and becomes impregnated with the solution.

A point of iron representing, like that of the metallic band, the extremity of the conducting wire, leans, slightly inclined, resting by its own weight upon the damp paper band, and is in communication with the earth. The voltaic current decomposes the wet portion, and leaves a coloured deposit which represents the signals of the despatch.

The working of this apparatus is entirely mechanical. The transmission and the reception of the despatches take place automatically; one clerk superintends the machine. In order to compose the despatches into conventional signals on the metallic band, another instrument, called the compositor, is employed, similar to that of Morse, the signals of which are employed. The band of metallic paper unrolling itself is raised by a lever so as to touch a thick roller covered with a resinous preparation in fusion, which cools suddenly as soon as it is applied to the metallic band. One clerk can prepare alone 35 to 40 despatches per hour; the telegraphic staff acquainted with the Morse apparatus can, without any study, compose despatches. For the service between Paris and Lyons three compositors suffice completely for the transmissions. The despatches reproduced on a band of chemically prepared paper are handed over to other clerks, who translate them for the printed despatches distributed to the public.

The result is that two composing clerks, two translating clerks, and a superintendent of the machines of reception and transmission, do as much work by aid of a single conducting wire as six clerks with three wires by the ordinary telegraphic system. A composing apparatus furnished with electro-magnets has been established on a line from London to Paris. When the *employé* in London wishes to transmit a telegram to Paris for the Lyons line, the only line in which this rapid service is installed, he manipulates as for the ordinary transmissions of the Morse apparatus; the letters or conventional signs are printed on a metallic band, and a few seconds afterwards are transmitted to the chemically prepared paper.

Thus we have before us a great improvement in modern telegraphy. Up to 11th September last the service of the Lyons line was carried on by aid of two or three Hughes' apparatus; each apparatus occupies two clerks and three batteries. By the new system five clerks do all the service with one line only. The new system works admirably and without a single hitch, and we can affirm that the invention of MM. Chaudassaignes and Lambrigot is destined to render great service to the telegraphic service. The economy of installation, and the saving effected in the number of clerks, the maintenance, wear and tear, &c., are marvellous.

By decree of the 16th October, M. Bertin-Mourot was named director of the scientific studies of the Normal College, in the place of M. Pasteur. M. Balard was named inspector-general of the order of sciences in place of M. Dumas. M. Pasteur undoubtedly will become professor of chemistry at the Faculty of Sciences of Paris in place of M. Dumas. Under the name of Bertin-Mourot the learned world will recognise M. Pierre Auguste Bertin, the skilful and zealous physician who has left so happy a *souvenir* in the Faculty of Sciences of Strasburg.

F. Moigno.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Cobaltic Sulphide.—Th. Hiortdahl. Black cobaltic oxide heated to redness in a current of sulphuretted hydrogen fuses, and is converted into a yellow sulphide of a strong metallic lustre, of the composition Co_4S_3. Dehydrated cobaltic sulphate fused together with baric sulphide and an excess of sodic chloride, yields a mass in which after cooling prismatic crystals are observed. Sometimes the baric oxide, formed during the reaction, separates in large leafy crystals which are intersected with prisms of the sulphide. This cobaltic sulphide is of a grey colour, and shows metallic lustre; it is soluble in acids, even acetic acid, and its composition is CoS.—*(Comptes R.* lxv. 75.)

Volcanic Gases.—Janssen has investigated the flames of the volcano of Santorin by means of the spectroscope, and found in it sodium, hydrogen, copper, chlorine, and carbon.—*(Comptes R.* lxiv. 1303.)

Nitriles, Action of Bromhydric Acid on.—C. Engler. If a current of dry bromhydric acid is passed through propio-nitrile (from potassic cyanide and sulphovinate) a crystalline mass is obtained which is propionitrilic dibromhydrate NC_3H_52HBr. It fuses between 50° and 55°C., and sublimes when heated a little above that temperature. It is pretty stable in dry air, but decomposes readily in moist air with formation of propionic acid. The following equation shows the decomposition caused by water:

$$NC_3H_5,2HBr + 2H_2O = NH_4Br + \left.\begin{matrix} C_3H_5O \\ H \end{matrix}\right\} O + HBr$$

The reaction between benzonitrile and bromhydric acid takes place in an analogous manner, benzonitrilic dibromhydrate, $NC_7H_5,2HBr$, being formed. This compound differs little in its properties from the one just described; it fuses at 70°. Its decomposition with water gives rise to the formation of benzamid according to the equation:

$$NC_7H_5,2HBr + H_2O = N\begin{cases} C_7H_5O \\ H_2 \end{cases} + 2HBr$$

(*Zeitschr. Chem.* N.F. iii. 506.)

Carbohydrates, Action of Water at high Temperatures on.—O. Loew. Cane-sugar is decomposed when heated with water in sealed tubes to 160° C., carbonic anhydride is formed and carbon separates, the latter amounting to nearly half the quantity of sugar taken. The contents of the tube show strong acid reaction, due to formic acid; a small quantity of ulmic acid is also formed. No decomposition takes place if sugar is heated with alcohol to the same temperature, or with a solution of baric hydrate. Other members of the sugar-group treated in this manner show a similar behaviour. The action of water on gum gives rise to the formation of a new acid which is insoluble in water but soluble in alcohol and ether.—(*Sill. Am.* J. [2] 43, 371, and *Zeitschr. ch.* iii. 510.)

Ferrocyanides, Volumetric Determination of.—Gintl. The solution containing a ferrocyanide-compound is acidulated with sulphuric acid (in preference to chlorhydric acid, which causes turpidity), a trace of a soluble ferric salt is added, and the quantity of ferrocyanide measured with a standard solution of potassic permanganate. The end of the operation is marked by the sudden change of the originally blueish-green colour of the solution into a yellow and finally red tint.

Ferricyanides are previously converted into ferrocyanides by reducing them with sodium-amalgam.—(*Akad. Z. Wien.* lv. 1867.)

MISCELLANEOUS.

Experiments in Electrolysis.—It has generally been inferred that the power of nitro-hydrochloric acid as a solvent for gold and platinum is owing to the evolution of free chlorine. The proof of the inference has been this:—When aqua-regia is heated until no more chlorine is evolved, the residual liquid is "found to be a solution of hydrochloric and nitrous acids that is incapable of dissolving gold."—*Turner.* In experimenting on the electrolisation of compounds the other day, it occurred to me that this hypothesis is capable of decided proof; and this was the series of experiments. (1). Into an ordinary apparatus for the electro-chemical decomposition of water, having platinum electrodes, a weak solution of hydrochloric acid was poured. Over the anelectrode a glass tube was placed, and in this tube some gold leaf. Twelve pairs of Wollaston's double coppers were employed excited by dilute sulphuric acid only. On completing the circuit, the penetrating odour of chlorine was very perceptible, and in a few seconds the gold in the tube over the anelectrode was completely dissolved; as also were some fragments that had been put into the solution outside the tube. (2). If chlorine has this power over gold it may be supposed that the chloride of either a metal or an alkali, providing that the compound is an electrolyte, will exhibit, on electrolysation, the same result. Chloride of sodium was the substance first experimented with. A saturated solution of the salt was made, and with precisely the same arrangement as before, the gold in the tube over the anelectrode was speedily dissolved. (3). The same result was obtained on electrolysing a solution of chloride of ammonium and chloride of barium. By a power of 20 pairs of Wollaston's double coppers the gold was dissolved with a rapidity equal to that when a solution of chloride of sodium was the liquid electrolysed. Both times the blue colour of litmus was quickly discharged, but there was no previous reddening of the colouring matter to indicate the generation of hydrochloric acid. (4). A solution of chlorate of potassa was the liquid next electrolysed. With the same power of 20 plates the gold was very gradually dissolved, though the battery was in good action. The odour of chlorine was perceptible, though fainter than in the former experiments. A solution of litmus was poured into the vessel, and a tinge of red was then perceived at the anode owing to the action of the evolved chloric acid upon the colouring matter. The blue colour of the solution became fainter by degrees, evidently proving that since chloric acid does not possess bleaching properties, free chlorine was evolved. Possibly this formation of chlorine from chloric acid is a secondary result of the current; but it is quite as probable, and more so, that the chlorate of potassa and the chloric acid were successively decomposed by the current of electricity. I am not aware that the dissolution of gold, and the influence of chlorine over the metal has been shown in this way before. True, Davy has proved that nitro-hydrochloric acid does not dissolve gold unless free chlorine is developed. Mr. Grove, also, has shown the action of chlorine liberated by the voltaic current; but in a different way. Two strips of gold leaf, one in nitric, the other in hydrochloric acid, in contact through a porous division, were connected by a gold wire: the hydrochloric acid was decomposed, and the gold in it immediately dissolved. The experiments now made, may not possess the less interest because they refer to a foregone conclusion, and show that by the decomposition of other compounds of chlorine besides hydrochloric acid the precious metals may be dissolved.—*Ernest W. Bartlett.*

The Pascal-Newton Forgeries.—Sir David Brewster has forwarded the following letter to the *Times*:—"As the French Academy of Sciences is now convinced that the Pascal and Newton Letters are forgeries, it has become an object of interest to discover the name of the forger, the time when he executed his work, and the motives by which he was influenced. That M. Pierre Desmaizeaux, a Frenchman resident in London, was the author of these forgeries, will appear from the following considerations:—1. Desmaizeaux resided in England between the years 1692 and 1745, the year of his death. He was a Fellow of the Royal Society, and was intimately acquainted with Newton and with the leading scientific men of the day. He was a contributor to the *General Dictionary*, as is stated in the preface to that work, and he possessed that knowledge of physical science which appears in the correspondence between Pascal and Newton. 2. Desmaizeaux's work entitled *Recueil de Diverses Pieces, &c., par Leibnitz, Clark, et Newton*, several portions of which appear in the forged letters of Newton, connect him in a peculiar manner with the forgery. 3. Desmaizeaux is the most important personage in the fabricated documents—the hero in the romance so ingeniously composed to transfer the discoveries of Newton to his countryman. He is himself the author of six of the letters published by M. Chasles, and no fewer than nine are addressed to himself by some of the most distinguished writers of the day. 4. Desmaizeaux's poverty adds to the evidence of his being the forger. He lived chiefly by his writings. He was employed by Dutch booksellers to send them literary news from England. In a letter to a nobleman, in 1732, he states 'that he was reduced to a pension on the Irish Establishment, which brought him in £40 a year.' . . . 'After 40 years stay in England, and in an advanced age, I find myself and family destitute of a sufficient livelihood, and suffering from complaints in the head and impaired sight by constant application to my studies.' 5. Desmaizaaux's character, both in its religious and moral aspect, was quite consistent with his criminality as a forger and a systematic slanderer of Newton. 'He was a great

man,' says Mr. Disraeli, 'with those who are pleased to be called Free-thinkers, particularly with Mr. Anthony Collins, and collects passages out of books for their writings.' Anthony Collins, who was a great friend of Locke, placed such confidence in Desmaizeaux that he bequeathed to him eight octavo volumes of his manuscripts, 'in order,' as Disraeli says, 'that they might be secured from the common fate of manuscripts.' In an unguarded moment, however, he relinquished this precious legacy of the manuscripts, and accepted 50 guineas as a 'present' from Mrs. Collins, who, it is supposed, threw them into the fire. 6. A large portion of the forged correspondence, embracing 120 letters from Newton, and 88 letters and notes of Leibnitz, was in Desmaizeaux's house at the time of his death in 1745, and either he himself or his family sold it for £800 to a celebrated collector of manuscripts. During the interval between 1734 and 1740 he had no doubt good employment as a contributor to the *General Dictionary*, and it is therefore probable that he spent the last five years of his life in the difficult work of composing the Pascal and Newton Correspondence. That his motive was to caluminate Newton, who was his friend, and exalt Pascal, who was his countryman, is by no means probable. In 1743, two years before his death, he had, as Disraeli tells us, 'procured his pension to be placed on his wife,' and there can be little doubt that his crime against Newton, like his crime against Collins, had no other object than to make a provision for his family."

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2657. J. Hargreaves, Appleton-within-Widnes, Lancashire, "Improvements in the manufacture of iron."—Petition recorded September 21, 1867.

2952. W. Crossley and T. C. Hutchinson, Middlesborough-on-Tees, "Improvements in the manufacture of alumina and salts of alumina from blast furnace slag, or from other silicates of alumina containing an excess of lime or magnesia."—October 21, 1867,

2976. S. Welton, Grafton Street, Fitzroy Square, Middlesex, "Ozonised or oxygenated bread, biscuits, cakes, and other substances."—October, 23, 1867.

2984. F. Gerharz, Cologne, Rhenish Prussia, "Improvements in the manufacture of manures and disinfectants."

2998. R. Weare, Compton, Staffordshire, "Improvements in and in apparatus for the treatment and for the reception of urine and fæcal matter."—October 24, 1867.

3006. W. R. Lake, Sonthampton Buildings, Chancery Lane, "Improved modes of and means for curing, drying, preserving, and packing meat, fruit, vegetables, and other perishable substances."—A communication from D. E. Somes, Washington, U.S.A.—October 25, 1867.

3032. J. Young, Aspull, Lancashire, "Improvements in the application of Cannel coal 'slack' to the manufacture of gas and coke."—October 28, 1867.

NOTICES TO PROCEED.

1845. J. Webster, Birmingham, "A new metallic zinc paint."

1850. L. Brunetti, Rovigno (Italy), "An improved process of embalming and preserving animal substances from decay for anatomical purposes."—Petitions recorded June 25, 1867.

1900. A. M. Fell, West Calder, Mid Lothian, N.B.,—"Improvements in purifying or preservative compounds to be applied to the fleeces or skins of sheep and other animals."—June 29 1867

2034. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the manufacture of refined sugar."—A communication from E. P. Eastwick, Baltimore, Ma., U.S.A.,—July 11, 1867.

2484. C. Gelstharp, Low Walker, Newcastle-on-Tyne, "Improvements in the manufacture of malleable iron, cast iron, and steel, and in the construction of furnaces to be employed for such purposes."—September 2, 1867.

MEETINGS FOR THE WEEK.

Thursday, November 21.

CHEMICAL SOCIETY.—"On Pyrophosphoric Amides," by Dr. Gladstone. "Connection between results of Analysis and Sanitary Condition of Water," by Mr. Chapman.

Friday, November 22.

QUEKETT MICROSCOPICAL CLUB, University College, Gower Street, —"The Wools of Commerce," by Mr. N. Burgess.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften zu Wien. (Mathematisch-naturwissenschaftliche Classe.)

March, 1867.

H. HLASIWETZ, "On Hydrocaffeic and Hydroparacoumaric Acids." A. ROLLETT, "On the Effect of Contrast on Colours." J. SEEGEN, "On the Separation of Nitrogen from Albuminoid Substances in a Dog." V. VON LANG, "On the Optical Properties of Crystallised Compounds of Ammoniacal Bases, and of Salts of Thallium, Rubidium, and Cæsium, with respect to to Homologous and Isomorphous Series." A. ROLLETT, "On the Theory of Accidental Colours, and of the Change in the Colour of Accidental Images."

April.

M. EROFEJEFF, "On the Determination of the Principal Index of Refraction of Sulphate of Ammonia." V. VON LANG, "An Improved Apparatus for Measuring the Optic Axes of Crystals." W. VON HAIDINGER, "On J. Schmidt's Observations on Meteoric Stones, and on the Ridges of the Surface of the Moon." O. REMBOLD, "On Quinotannic Acid." O. REMBOLD, "On Quinova-tannic Acid." A. GRABOWSKI, "On Rhatania-tannic Acid." G. MALIN, "On Filico-tannic Acid." A. GRABOWSKI, "On Filicic Acid." O. REMBOLD, "On the Tannic Acid of the Root Bark of the Pomegranate Tree." H. HLASIWETZ, "On the Relations between the Tannic Acids, Glucosides, Phlobaphenes, and Resins." E. BRUCKE, "On the Action of Boracic Acid on Living Muscular Fibre." E. KLEIN AND E. VERSON, "On the Importance of Salt as an Article of Human Food."

Sitzungsberichte der Königlich-Bayerischen Akademie der Wissenschaften zu München. (Mathematisch-physikalische Classe.)

February 9, 1867.

M. VON PETTENKOFER and VOIT, "On the Carbonic Acid exhaled and Oxygen consumed by Man." VON KOBELL, "On the Behaviour of Disthene in the Stauroscope, and on the Permanence of the Cross observed under such Circumstances." A. VOGEL, "On the Estimation of Fat and Albumen by a Method based on the Principle of the Optical Milk Test."

Jahrbuch der Kaiserlich-Koniglichen Geologischen Reichsanstalt.

January-February, 1867.

V. VON ZEPHAROVICH, "On Fluorite from Hieflau, Styria." F. RAUEN. "Note on the Present condition of the Ore-washing Establishments of Schemnitz." K. VON HAUER, "Analysis of Brown Coal, Lignite, Copper, Slag, and Iron Ores."

NOTES AND QUERIES.

Palm Oil.—Where can I find instructions for isolating the colouring matter of palm-oil; or how it can be effected?—S.

Perfect Vacuum.—"Electron" will find a paper by Dr. Andrews on a method of obtaining a perfect vacuum, in the Philosophical Magazine, series 4, vol. iii., p, 104. I believe Mr. Cetti now makes vacuum tubes so perfect that they will not allow an induction current to pass. I believe the process for making these has also been published, but I cannot say where.—W. THOMPSON.

Chloride of Barium.—Your Paris Correspondent, in a recent number of your valuable journal, states that Messrs. Burgoyne and Co. manufacture chloride of barium in a pure state, and that they are selling the same at £30 per ton. To my thinking £30 is a very high price to ask for this article; I wish therefore to state that I have made large quantities of chloride of barium, nearly absolutely pure, disposing of the same (of course at a profit) at £9 per ton.—J. H. SWINDELLS.

TO CORRESPONDENTS.

NOTICE.—The Printing and Publishing Offices of the CHEMICAL NEWS *will shortly be removed from Wine Office Court, Fleet Street, to*

BOY COURT, LUDGATE HILL, E.C.

R. Medwin Hands.—Consult the Free Library of the Patent Office Southampton Buildings, Chancery Lane.

W. B. G.—Wöhler's researches on the nitride of boron may be found in the *Chemical Gazette*, vol. vii. p. 234. We shall be glad to hear particulars of your experiments.

Student.—There is no cheaper process for procuring chlorine on a large scale than the reaction of sulphuric acid and salt, or of hydrochloric acid, on binoxide of manganese. This is the process universally adopted in chemical works.

T. W.—Asks how to precipitate double chloride of platinum and aluminium from a solution of the two metals in *aqua regia*. No such compound is known. It might possibly be obtained by careful evaporation of the acid solution referred to, but it could not be *precipitated*.

THE CHEMICAL NEWS.

VOL. XVI., No. 416.

ON THE SEPARATION OF CERIUM FROM DIDYMIUM AND LANTHANUM.

By M. M. PATTISON, Andersonian, Glasgow; and JOHN CLARKE, Ph.D.

THE following method has been found to be very effective for the separation of cerium from didymium and lanthanum:—

It is based upon the fact that when chromate of cerium is evaporated to dryness and heated to about 230° F., it is decomposed, and the oxide of cerium remains as an insoluble powder, whilst the chromates of didymium and lanthanum, when subjected to the same treatment, remain unchanged.

The mixed oxides of cerium, didymium, and lanthanum are subjected to the action of an aqueous solution of chromic acid, aided by heat till solution is complete. The chromic acid need not be entirely free from sulphuric acid. The solution obtained is evaporated to dryness, and the residue heated to about 230° F. Hot water is then added, which dissolves the lanthanium and ddymium and leaves the oxide of cerium, which is then separated by filtering. Thus obtained, the oxide of cerium is a yellowish-white powder which is almost completely insoluble in acids, but is rendered soluble when fused with the acid sulphate of potassium.

This process may also be employed for the quantitative determination of cerium, as it was found by careful trial that not a trace of cerium could be detected by the best known processes in the solution, after its separation, as above described.

ON THE COMPOSITION AND METALLURGY OF SOME NORWEGIAN IRON ORES.

By DAVID FORBES, F.R.S., &c.

THE iron ores here under consideration were all strongly attracted by the magnet, and, with the exception of traces of iron pyrites and pyrrhotine, all the iron contained in them was found to be present in the state of magnetic oxide (Magnetite).

The percentage of metallic iron, besides being calculated from the amount of sesquioxide of iron obtained in the course of the analysis, was also determined in a separate portion of the ore by the bichromate of potash volumetric process, after its previous solution and reduction to the state of protoxide by metallic zinc; the oxygen combined with the iron was estimated from the loss in analysis.

The portion of the mineral employed for determining the amount of sulphur was dissolved in nitrohydrochloric acid, filtered from the insoluble siliceous matter, and the filtrate evaporated nearly to dryness in a water bath, so as to expel the excess of free acid (which otherwise might augment the solubility of the sulphate of barytes), and after having been precipitated by chloride of barium, the sulphate of barytes was estimated as usual.

Phosphorus was sought for in a larger amount of the ore, both by Abel's and Spiller's processes (CHEM. NEWS, vol. vi., p. 133, and vol. xiii., p. 170), and also by the molybdate process recommended by Eggertz.

The manganese was separated from the iron by carbonate of barytes, and the other constituents, carbonic acid, lime, magnesia, and alumina determined as usual.

The ores No. 1, 2, and 3 occur as veins in the limestones and calcareous shales of the Silurian formation lying to the west of the river Dram in Norway, and have long been worked for the supply of the charcoal blast furnaces in the vicinity.

These deposits of magnetite are in some places greatly disturbed by the intrusion of eruptive granite and trappean rocks; of these the granites are the oldest; breaking through the Silurian strata they frequently dislocate both these and the iron veins, and often send out dykes cutting through the masses of iron ore and dividing it into sections, or as it were, chambers, separated from one another by walls of granite of varying thickness; the quality of the iron ore does not appear, however, to have been affected or deteriorated at these points.

The trappean dykes, being of still later age, traverse alike both the Silurian strata, iron veins, and granitic intrusions, and in general are found to have a very injurious effect upon the iron ore in immediate contact with them, causing it (sometimes to the distance of several feet) to become more or less strongly impregnated with sulphur, which, combining with the iron, shows itself as pyrites and pyrrhotine, both of which minerals are usually found in greater or less quantity diffused throughout the substance of the rock of the dyke itself.

No. 1. Magnetite from the Aaserud mine, about 5 miles north west of the town of Drammen.

The specimen analysed was extremely compact in texture, strongly magnetic, and was intersected by minute veins of carbonate of lime; some traces of a greenish silicate were also visible, but otherwise the ore appeared quite free from impurity; it was broken out at a depth of 122 feet from the surface.

The specific gravity was found to be 4·56.

The chemical analysis afforded the following percentage composition:—

Iron, metallic	58·24
Oxygen (or loss)	22·20
Protoxide of manganese	0·14
Carbonate of lime	7·44
,, of magnesia	2·48
Alumina	8·00
Silica	1·35
Sulphur	0·15
Phosphorus	0·00
	100·00

In the metallurgical treatment of this ore, owing to its extreme compactness in texture, it requires a prolonged roasting in order to render it as porous and permeable to the reducing action as possible, since, when but lightly roasted, the ore always contains hard unaltered kernels, and is found to be much more irregular and refractory in the furnace.

The ore in lumps of the size of a fist, is roasted in (somewhat conical) cylindrical kilns fired by the waste gases from the blast furnace, brought down from a depth of about 16 feet below the top of the furnace. It remains in the roasting kiln about from twenty-four to thirty hours; the small amount of sulphur contained in the ore seems to be entirely removed during this operation.

Beyond being charged into the furnace, the roasted ore (and also the limestone used as a flux) is broken up by rolls or stamps to the average size of a hazel-nut, and the charges of ore, limestone, and charcoal are not allowed to exceed at a time about 600 pounds of the calcined ore along with from 30 to 60 lbs. limestone, and 34 cubic feet of fir and pine charcoal; the whole being carefully distributed over

the area of the furnace mouth. The blast is obtained from three double-acting horizontal boxes driven by a water-wheel and working into a regulator, from which the furnace is supplied by two tuyeres, the blast being previously the heated in an apparatus at top of the furnace fired by the waste gases. The dimensions of the blast furnace are as follows:—Diameter of hearth, 2 feet 6 inches; diameter greatest, 7 feet; height from bottom of hearth to tuyeres, 1 foot 6 inches; do. from line of tuyeres to greatest diameter, 7 feet 6 inches; do. from greatest diameter to top of furnace, 37 feet; consequent total height from floor of hearth to top of furnace 45 feet.

The bottom stone of the furnace is made of Newcastle sandstone, on which the first eight feet in height of the interior is formed of English (Newcastle) firebrick; above this the entire lining of the furnace is built of slag from the furnace itself, cast in the form of large brick moulds. These slag bricks have been proved to stand excellently; in some cases even for more than four years, during which the furnace has been in continuous operation. They appear to undergo a change similar to the conversion of glass into Reaumur's porcelain. The exterior of the furnace is built entirely of the rough unhewn stone of the neighbouring hills.*

When in good trim, and smelting the ore from the above mine (which, however, only averages about 44 per cent iron on the large scale) for the production of first-class charcoal pig for conversion into Bessemer steel, the burden and yield of the above furnace is about as follows:—

Ore smelted weekly, 68 tons; limestone (Silurian) used as flux, 5 to 6 tons; charcoal consumed, 10,750 English cubic feet; yield of pig iron, 30 tons, or 44 per cent of the weight of ore.

The furnace is tapped three times per 24 hours, at 8 a.m., 4 p.m., and midnight respectively, and the cast iron run into chills weighing each about 75 pounds.

The charcoal used is made from the spruce and Scotch firs, and burnt (in heaps) in the open air; as the weight of a given volume of charcoal differs greatly according to the season of the year, the quickness of burning, the length of time it has been burnt before weighing, and the humidity of the atmosphere, it is considered better to use volume instead of weight in such calculations; since, however greatly the weight may alter under these circumstances from the absorption of moisture, the bulk remains comparatively the same.†

When white iron is obtained (instead of the dark grey black) this consumption of charcoal is much diminished, and much more ore can be run through the furnace in the same time.

The slag is glassy, and of a light yellow or brownish tinge, containing only a mere trace of iron; when in thin splinters it is both transparent and colourless.

Until the last two years the whole of this iron has been manufactured with charcoal in Lancashire hearths, into hammered bars of a quality equal to the finest Swedish brands, and as this iron has shown itself particularly adapted for conversion into steel it has been chiefly employed for that purpose from as far back as the middle of the last century.

Since the introduction of the Bessemer process the pig iron from this ore has shown itself equally adapted for conversion into Bessemer steel of admirable quality, and the whole production is now employed for this purpose; the pig exported for conversion shows a dark black grey brilliant crystalline fracture, with the lower part chilled to the extent of half an inch or more; both parts, however, being very uniform in appearance.

No. 2. Magnetite from the Saasen mines, about four miles from the east side of the Ekeren Lake.

This ore is compact, strongly magnetic, and contains an admixture of a green silicate, probably epidote, along with a little carbonate of lime; the sulphur present in the ore is evidently in the form of pyrrhotine, as specks of this mineral are seen disseminated in the ore. Its specific gravity was 4·22. On analysis its composition proved to be as follows:—

Metallic iron	61·88
Oxygen (or loss)	20·57
Protoxide of manganese	0·51
Carbonate of lime	3·24
Alumina	2·69
Lime	1·12
Magnesia	0·29
Silica	6·50
Phosphorus	trace
Sulphur	0·25
	100·00

This ore, although not quite so compact as that from the Aaserna mine, contains more sulphur, and consequently requires a prolonged roasting to get rid of this deleterious ingredient.

The roasted ore melts well, and requires about the same amount of charcoal for its reduction as the last described ore, affording a strong light grey iron slightly chilled; there was an evident tendency to the production of white iron.

The slag was nearly free from iron, of a dull yellow colour, and crystalline; it frequently showed streaks of a blue tint, which is commonly found when smelting ores containing sulphur, especially when irregularly roasted.

When converted with charcoal in the Lancashire hearth into bar, it afforded a good strong and tough bar, but in quality rather inferior to the iron from the Aaserna ore; the quality of this, however, would doubtless be much improved if more attention were paid to the sorting and roasting of the ore previously to smelting.

No. 3. Magnetite from the Narverna mine, about three miles from Drammen.

This ore was very strongly magnetic, and possessed a granular texture; it invariably contained particles of iron and copper pyrites disseminated throughout the entire substance of the vein mass; the only other mineral occurring in it appeared to be allocroite, which was frequent. The specific gravity was 4·39.

In the analysis, the copper was precipitated from the solution of the ore in hydrochloric acid by sulphuretted hydrogen, and determined subsequently as oxide; the composition of this ore was found to be:—

Iron, metallic	57·59
Oxygen (or loss)	23·22
Copper	0·79
Protoxide of manganese	0·65
Lime	2·85
Magnesia	0·14
Alumina	3·55
Silica	10·25
Phosphorus	0·00
Sulphur	0·96
	100·00

On account of the amount of copper and sulphur contained in this ore, the pig-iron produced in the blast furnace was not convertible into malleable bars when treated with charcoal in the Lancashire hearth.

As the ore itself on the large scale contained an average of over 50 per cent iron, and the deposit was capable of yielding an immense supply at a nominal price, it became

* The iron works here referred to are respectively situated at Eidsfoss, on the Lake Ekeren, and at the mining town of Kongsberg. The author has been connected with the same in the capacity of consulting engineer ever since 1847, first to the Norwegian proprietors, and now to the present owners, the Norwegian Charcoal Iron Company.

† Two different managers of these works considered one English ton of charcoal as equal to 242 and 255 English cubic feet respectively. The consumption of charcoal according to the above data will consequently be about 158 cubic feet per ton iron ore smelted, or 358 cubic feet per ton pig iron produced.

of some importance to inquire whether some means might not be found to eliminate the sulphur and copper, and thus enable the ore to be utilised for malleable bars.

For this purpose several experiments were made (both on the small and on the large scale) in roasting the ore in lumps in kilns as well as in coarse powder in a reverberatory furnace heated by the waste gases of the furnace, sometimes with the assistance of a jet of steam playing upon the red hot ore during the calcination. In some instances the ores thus treated were at once reduced in the blast furnace, but in others they were spread out in the open air, and occasionally sprinkled with water in order to facilitate the oxidation and dissolve out any sulphates of iron or copper formed. After well washing out they were again roasted and melted. Although much better results were obtained by so treating the ores, the bars were never sufficiently good for the charcoal iron market, and the results of these experiments were conclusive only as showing that on the large scale, the ores could not, practically, be sufficiently purified to fit them for the production of malleable bars of good quality.

The pig iron produced from this ore, even when roasted in the ordinary manner, is well adapted for foundry use, and is employed with advantage in making the finest ornamental castings. For this purpose a small admixture of common English pig (about 20 per cent) is usually added, and is considered to render the metal softer.

In order to examine whether the ore could be smelted to advantage with coke imported from England, instead of with charcoal, a trial smelting of some weeks' duration was made with Newcastle coke in the same furnace (the dimensions of which have already been given) which was employed for smelting the ore with charcoal.

The furnace was evidently not well adapted to coke. The hearth (of stamped quartz powder) did not stand well; the blast appeared too weak for the heavier coke.

The results, however, possess considerable interest, since both smeltings were carried on under similar circumstances.

Not taking into consideration the irregularity of the actual smelting trials, the results of these experiments may be stated approximatively as follows:—

	Smelting with charcoal.	Smelting with coke.
Iron ore smelted per week	70 tons	80 tons
Cast iron produced ,,	36 ,,	41 ,,
Charcoal consumed ,,	44 ,, (10,800 cubic ft.)	— ,,
,, per ton iron ore smelted	0·63 ,,	— ,,
,, ,, cast iron produced	1·22 ,,	— ,,
Coke consumed per week	— ,,	·44 ,,
,, per ton iron ore smelted	— ,,	0·55 ,,
,, per ton cast iron produced	— ,,	0·88 ,,

In both cases the percentage of cast iron obtained from the ore was about the same, or an average of 51·3 per cent.

Other experiments with coke make it probable that under conditions more favourable to its employment, much more advantageous results would have been obtained.

No. 4. Magnetite from Ringkjern mine, Sandsvoerd, near Kongsberg.

The lode containing this ore was situated in granite gneiss, cutting this rock at a nearly vertical angle.

It contained small veins and fragments of white and nearly pure quartz associated with it, as well as occasionally traces of violet fluor spar, and, besides these minerals, it also had numerous specks and large blotches of iron pyrites, from which it could only be separated by careful breaking and hand picking.

The magnetite itself presented an appearance totally different to that of this mineral in general, and would be at first sight taken for iron glance or specular iron ore, since it consisted entirely of an aggregate of radial plates or scales of the mineral, of a bright black metallic lustre. It gave, however, a black to brownish black streak, and was very strongly magnetic.

The specific gravity were 4·16: the results of its chemical analysis were found to be as follows:

Metallic iron	67·73
Oxygen (or loss in analysis)	25·81
Protoxide of manganese	0·32
Lime and magnesia	traces
Alumina	0·75
Silica	5·00
Sulphur	0·39
Phosphorus	traces
	100·00

This ore, owing to its peculiar foliated texture, roasts with great ease, and also reduces well in the furnace, but always yields a white pig, which has only been employed for castings. The slag produced was clean, and of an opaque yellow colour, frequently crystalline, and always having blue streaks, apparently due to the sulphurous ore.

The amount of silica contained in this ore accumulated a much larger amount of limestone as flux than was required when smelting the three before described iron ores. Some experiments made on this pig-iron converted with charcoal in a Lancashire hearth produced hammered bars of inferior quality, being red-short. They, however, possessed no trace of cold-shortness, and were of an extremely tough fracture when broken cold, so that it is probable that a better sorting and calcination of the ores would enable the ore of this mine also to be employed in the manufacture of hammered bars for the market.

ON THE DEVELOPMENT OF IDEAS IN NATURAL PHILOSOPHY. *

By JUSTUS VON LIEBIG.

(Continued from page 252.)

The definitions of natural phenomena by the Greek and subsequent philosophers prove the extent and comprehension of their "derived ideas," and nothing more; and from this point of view they offer a peculiar interest for the history of the development of ideas in natural philosophy, inasmuch as we discover in them the first outlines in the elevation of our ideas. Aristotle distinguishes the solid from the liquid and the æriform. All solid bodies are to him varieties of *one* solid; it can be perceived that transparent bodies have something in common with water, but language does not suffice to define the other varieties of solid bodies, such as form, colour, or hardness; only what can be produced from them or what results from them are definable. One white stone yields in the fire lime, another white stone fuses to glass, one red stone produces iron, another mercury, a grey stone tin, a black one lead. "The essence of things," Aristotle says, "lies in the form." *This is the first conception of chemical analysis.*

Daily experience teaches us that solid bodies cannot float "in the air or in space without being suspended by something; and as the stars are seen behind the moon, and the moon is nearer to the earth than the sun, these celestial bodies, being solid bodies, must be fastened to transparent rings or discs which move round the earth together with the celestial bodies."

A freely falling stone moves towards the earth with increasing velocity; sense and mind are quite incapable of recognising that the earth has any part in the falling; it is evident there must be a desire within the stone to return to the place assigned to it by nature." *This is*

* A Lecture delivered at the Meeting of the Royal Academy of Science, at Munich.

the commencement of the idea of gravity, or of an attractive force.

These ideas of the Greeks were perfectly in harmony with their experience, and correct so far as they could not have any others. The idea of time, embodied in the compound idea of velocity, was developed and incorporated with the latter 1,500 years after Aristotle. Watches or measures for short intervals of time the Greeks did not possess. At the commencement of investigation of nature the compound phenomena of rain, of the rainbow, of burning and breathing, are taken simply as a matter of course, for nothing is known of their parts; at a later period it is discovered that the rain is preceded by a formation of clouds, that without sun, no rainbow is formed, and that without air, burning and breathing cannot take place. That part of the phenomenon which is observed at a later time is always looked upon as the cause, the sun as the cause of the rainbow, the air as the cause of breathing and burning, just in the same way as the course of the moon is thought to be the cause of ebb and flow of the tides.

And in this respect the tracing out and defining of the manifold relations of water by Thalso, of air by Anasimenes, of fire by Heraclitus, belong to the greatest discoveries, for these philosophers thereby created the field for all questions connected with the most important occurrences on the surface of the globe, with animal and human life—questions which have occupied us up to the most recent times.

From the acute analyses of words by the Greek philosophers, we learn with great precision the sum total of the ideas included in the words which they used in their mental operations, and it might suffice to compare the contents of one of these words—of the word "air,"—to obtain a clear conception of the "derived ideas" of those times and of their development.

The Greeks knew that air inclosed in a bladder resists pressure, and that a glass inverted into water does not fill with the water. Air was looked upon as a space filling, resisting matter, as an element, and next to fire, *i.e.*, smoke ascending into the air, as the lightest element. Up to the beginning of the 16th century, air was considered to be convertible into water,—in the middle of the 16th century as not convertible into water. It was found to contain water in a gaseous form; in the year 1630 the idea obtained that it was heavy, *i.e.*, ponderable matter; in 1643, that it pressed with its entire weight upon all bodies on the surface of the globe; in 1647, that the invisible particles of air press also upon each other and are elastic, that the lower air strata are denser than the upper ones; in 1660, that different kinds of air or gases, elastic like common air, could be artificially produced by chemical processes; in 1727, that such like gases were also in plants, animal matter, ores, and metallic calxes, not as products, but as educts, some inflammable, some stifling fire. In 1774, it was found that among these gases was one in which inflammable substances burnt more briskly than in common air, in 1775, that atmospheric air consisted chiefly of a mixture of two gases, one of which supported combustion, the other not, also that it contained variable quantities of aqueous vapour; at the end of the 18th century, that it contained carbonic acid; in the 19th century, that it also contains ammonia, nitric acid, and, lastly, that all kinds of fungi were floating in the air. Our position in regard to the notion of "air" has been acquired by the labour of hundreds of the most clear-sighted men during an interval of more than 2,000 years, by constantly enlarging, separating, and limiting the first notions; and this constitutes the difference between all notions of matter and of phenomena formerly entertained and, those we have to-day. By-and-bye I shall take occasion to show that the discovery of facts which were added to the notion of air, and which gradually enlarged and defined more completely its extent, was precisely the conception of the facts, *i.e.*, that they were first "conceived" and afterwards discovered.

It will easily be observed that most of our notions in philosophy, and especially in jurisprudence, have been traced out and developed in an exactly similar manner, and that our present ideas of the words "state" or "church" convey a different meaning to what they did 100 years ago. "The idea of divinity" changes and developes with the notion of "force."

Every one of our present notions is the result of time and of infinite labour and mental effort, and if our speculations are less bold than those of the Greeks, it is exactly because their example has taught us that the highest flight of imagination and the most acute logic do not alter our position, and that they are without influence upon the regular course of the development of the "derived ideas." Euclid, with his powerful mathematical mind, thought we looked out of the eyes by means of optical rays. Descartes, one of the greatest philosophers of all times, could not raise himself to the idea of an attractive force.

Very widely spread is the opinion that a gap exists between the Greek and modern philosophy up to the 15th century, and the historians designate the middle ages as the period of stand-still, and the 15th century as that of the re-awakening of science.

This view if applied to Europe is only partly correct, and it cannot hold good for the western parts of Europe, for Germany, England, and the present France. In these countries Greek and Roman culture could not be extinguished in the middle ages, simply because it found entrance into them only at a much later period. We must recollect that at the time of the Academies of Athens Western Europe was inhabited by half savage races who were clothed in hides, that under Charlemagne most of the dignitaries and the most powerful barons of the empire could not write their own names, that in the 13th century Rome was still the centre of the Christian slave trade, and that large slave markets existed at Lyons and in the coast towns of the German Ocean and of the Baltic.

The endeavours of the great Emperor to impart mental cultivation into the rude and ignorant clergy of his time, by the foundation of schools, could not be crowned with success, because the ground on which culture spreads had not been prepared by cultivation. The development of culture, *i.e.*, the enlargement of the sphere of the human mind, depends upon the increase of inventions of the populations, which modify the progress of their civilisation; for by these inventions new facts are gained from nature which are absolutely indispensable for the augmentation of the "derived ideas," or the matter of human thought. But other conditions are yet required for the development of science, whose parent is Culture. Science depends upon the rise of a social class which devotes its energy to the cultivation of the mental domain to the exclusion of every other purpose. The men who apply themselves to this task do not produce any articles which they can realise in exchange for the necessaries of life, like goods in the market, and therefore such a social class cannot spring up until a certain surplus of wealth has accumulated amongst the populations not necessarily required by its possessors to meet their material needs. Only with the introduction of such a state of things are the mental demands of any avail, and the proprietary class exchanges part of its wealth for the sake of cultivating the mind.

Although an uninterrupted traffic without obstacle to the diffusion of Byzantine learning existed in the middle ages between the Eastern Roman Empire and Italy, this learning did not pass over into the Western countries until the 14th century, because the intellectual class had not yet been formed, and with it the conditions of the cultivation and development of learning were still wanting. Naturally Greek culture could only grow up in Western Europe in the same ratio as the civilisation of the populations approached that of Greek antiquity.

It can easily be proved that the civilisation of European populations continually increased after the decline of the ancient Greek states; but owing to peculiar circumstances, to which I will presently allude, it remained for a time without influence upon the progress of culture, *i.e.*, of its mental domain, and hence apparently a gap.

In reference to the share which inventions bear in the development of the conceptions and ideas in natural philosophy, it will be sufficient to draw attention to the facts that the true view of the motion of the earth and the planets originated with the invention of the telescope, and that all progress in astronomy depended upon the perfection of optical instruments. The invention of the telescope was preceded by that of colourless glass; the further improvement of optical instruments depended upon the invention of flint glass, and of the achromatic lens, which Newton thought impossible. By means of Galileo's instruments Uranus and the satellites of Saturn could not have been discovered. Copernicus looked upon his view not as "true," but as more simple and more beautiful, in the same manner as we take the notions of a physiologist of "good" and "beautiful," not in the meaning of true, as it is true that $2 \times 2 = 4$, but as "suitable" "profound," or "exhaustive." Chemical analysis resulted from the manipulations of the metallurgists, mineral chemistry from pharmacy and from chemico-technical manufactures, organic chemistry from medicine. The theory of heat has been amplified by the steam-engines, the theory of light by photography.

In astronomy the Greeks accomplished the utmost they possibly could with a simple, single sense; they discovered the law of reflection of light, the arithmetical laws of sound, the centre of gravity, the law of leverage and of hydrostatic pressure, and whatever could be deduced from these laws and astronomical observations by means of mathematics; any further progress was excluded by the degree of their civilisation. The source of the trade, wealth, and power of the Greek states in their most flourishing period was a highly developed, extensive industry; Corinth produced what we might call Birmingham and Sheffield goods; Athens was the centre of the products of manufactures now spread over Leeds, Staffordshire and London, such as woollen textiles, dye-stuffs, ceramic wares, gold and silver articles, and ship-building. The citizens were manufacturers on the largest scale, ship-owners and merchants who had their offices and factories on all coasts of the Black Sea and the Mediterranean; the men of science were the sons of citizens, and well-acquainted with manufactures, industry, and commerce. Socrates was a stonemason, Aristotle an apothecary (compounder of medicines and a medical man), and Plato and Solon were no strangers to trade. The men of science spoke and wrote in ancient Greece the same language as the tradespeople; in cultivation of the mind the latter were on a level with the philosopher, the difference consisted only in the direction of their knowledge; democratic governments and institutions united both in an intimate personal intercourse, and indeed the thirty-eight chapters of the "Problem" appear to be nothing else but questions of tradespeople, artists, musicians, architects, or engineers, which Aristotle tried to solve as far as his "derived ideas" permitted.

No other land in the old world combined in the same degree as Greece, up to the time of Pericles, in her social arrangements, in the close connection of the productive and the intellectual class, the necessary elements for the origin of science. But Greece was a slave state, and slavery was the bane which confined Greek civilisation within certain limits, and made them impassable. All products of the Greek manufactories were the result of slave labour. At the time when Athens flourished there were nearly 2000 slaves for every 100 citizens, which number gives us an idea of the extraordinary development of the Athenæan industry.

Now a tradesman or artisan is not able to produce by himself alone more value than he requires for the very necessaries of life for himself and family, but he must be able to command at will the strength of 20 or more people if he will realise an excess of products of industry large enough to satisfy the requirements of part of the population of the land in which he lives, and all tradespeople in the land put together must produce a very much larger excess if their products are to become articles of export. This last proportion exists in all industrial commercial states, and it did exist in Greece, for the accumulation of wealth in precious metals in the country had not been effected by plunder, but by exchanging products of Greek industry in other countries for the people of which they had more value than gold or silver.

The progress in Greek civilisation chiefly depended upon the transition of the slave state into a free state, which cannot be imagined without the utilisation of natural forces by means of complicated tools or machinery which do the work of slaves.

It is evident that by the invention of machinery, which converts a given natural force, the weight of falling water for instance, into power of labour, and thereby performs the work of 20 people, the inventor may become rich and the slaves free men, and the natural consequence of the introduction of machinery is an increase in the productive class, and thereby in the number of inventors and an enlarged production of the country. But in a slave state the application of natural forces and the substitution of slave labour by machine work is almost impossible, for the profit and wealth of the possessing class in such a state consists in the slaves, and every single citizen sees his property *de facto* endangered by the introduction of machinery; and if the citizens, as then in Greece, form part of the authorities, government and people combine to make the existing state of slavery permanent, the government with the apparently wise intention of securing to the labouring population their livelihood.

The free man only, and not the slave, has the inward impulse and an interest to improve his implements or to design new ones, and thus the workman who builds up a complete machine generally participates as co-inventor. The regulator and other most important parts of the steam engine are inventions of workmen.

Any improvement in the methods of once established routine and manufacture by slaves (themselves working machines) is out of the question.

Liberty, *i.e.*, the loosening of all bonds which prevents man from employing the powers bestowed upon him by God to his own best advantage, is the foundation and the principal condition for the progress of the human race in civilisation and culture.

A glance at China suffices to comprehend the influence upon a gifted people, resulting from simple exclusion of the natural forces in the execution of human labour by machinery; her high civilisation has thereby become stationary for the last 2000 years.

In England, and especially in the United States of North America, where antiquated institutions and laws, grown up from ignorance, do not impede the free employment of human forces, we see on the contrary a continuous increase in wealth, power and civilisation, and we can scarcely entertain a doubt that in the free states of North America all the elements exist to lead them to the highest scale of culture and civilisation attainable by men.

A modern state, in which free trade does not exist, in which the establishment or extension of a business depends upon the pleasure of ignorant officials, in which the free man is not allowed to choose the place he considers most suitable for the exercise of his powers, and in which he requires the permission of his masters to contract marriage,—this is the ancient slave state, in which the *élite* of the people is poor and without susceptibility for mental or moral improvement, and whose wealth and power form a deceptive varnish, easily rubbed off by slight friction.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

ROYAL DUBLIN SOCIETY.

AT the last evening scientific meeting of this Society, Dr. De Ricci read a paper "*On the Japanese Oak-feeding Silk Worm*" (*Bombay Japonica*). The speaker's attempts to rear this worm in Ireland had been comparatively successful, and from the results obtained he was inclined to believe that this species of silkworm could be easily acclimatised. The oak was the indigenous tree of this island, and he firmly believed that with care it would be feasible to establish in this country the cultivation of this important silkworm, and thus create a new branch of industry and a new source of wealth. The great disadvantage that this worm laboured under in this climate was that the worms were hatched before the oak leaved. Dr. Wallace, of Colchester, had previously failed in hatching this worm.

Amongst an interesting collection of minerals which had been brought for the museum of the Royal Dublin Society was a remarkable specimen of flexible sandstone from Delhi. Although ¾ of an inch thick, this sandstone could be moved about in the air like a piece of ribband, and exhibited either way a curvature of at least 5 or 6 inches from the original line occupied by the stone.

ACADEMY OF SCIENCES.

NOVEMBER 11, 1867.

(FROM OUR OWN CORRESPONDENT.)

Vacant Academic Chair.—The Imperial Observatory.—Functions of the Roots of Vegetables.—The November Meteors.—Parallax of the Sun.

IN a letter to the President M. Dubrunfaut requested the Academy to insert his name in the list of candidates for the vacant chair in the section of rural economy, and promised to submit to it the numerous titles which he possesses for the honour which he solicits. He will be received, we are sure, with open arms as one of our most eminent practical chemists. M. Dubrunfaut at an early age imbibed a taste for agriculture, and worked at its elementary practice. Taking into consideration that the great source of the prosperity of France is the industrial development of the soil, M. Dubrunfaut made himself a manufacturing chemist. Every one knows the immense progress he has made in the production of beet-root sugar and alcohol; the benefits to be reaped by the application of osmose and the purification of beet-root juice and molasses will be counted by millions of francs.

M. Elie de Beaumont commenced the reading of three long letters relative to the autographs of M. Chasles, two from Sir David Brewster, and one from M. Grant. The Academy decided that they should be inserted in the *Comptes Rendus*. It is high time, however, to finish this discussion, and M. Balard begged of M. Chasles to cease answering these assertions, and M. Chasles promised to publish all the original documents.

M. Leverrier called attention in a long note to the inconveniences experienced by the observatory owing to the new streets and constructions in the neighbourhood of the Saint Jacques quarter.

M. Corenwinder read a memoir on the functions of the roots of vegetables. It has been long known that the roots possessed the property of absorbing carbonic acid. M. Corenwinder proves on the contrary by his experiences that if these organs are put in communication with a certain proportion of this acid, either in a gaseous state or in solution in water, it is found that the quantity present in the roots is greater than that which had been supplied to the plant.

NOVEMBER 18, 1867.

MM. Coulvier-Gravier and Chapelas communicated the following note on the falling stars of November. The first great appearance of this phenomenon noted dates from 1766; the second, of 1799, was observed by MM. Humboldt and Bonpland. Consequently, if these apparitions are truly periodical these two observations furnish a period of 33 years. But, since 1799, we must arrive at 1833 for the observation of a similar phenomenon which has served as basis for the calculation of Olbers, by which he thought he could prove that the period of the phenomena of November was definitively 34 years, and that the first return would take place in 1867. Now, we are forced to note that the illustrious astronomer had not made a correct statement, for this year, though the moon was bright and the atmosphere foggy, we were able to ascertain the presence of only a veritable minimum. Last year the apparition was very beautiful, though inferior to 1833, and many observers watched impatiently the return of the phenomenon, relying on the theory of Olbers. Now the period has arrived and all observers have been able to state that the expected phenomenon of November was not produced. The solution of this problem must be postponed for som years.

This year M. Le Verrier had organised the observation of the falling stars of November. He had them observed at several places, but the height of the moon above the horizon had rendered observation almost impossible. At Limoges the sky was overcast, and in Paris too brightly lit up by the moon. They only observed before two o'clock a few meteors; from 2h. 48m. to 5h. 42m. the number of meteors seen in the moonlight were constantly on the increase. In the last hour before daylight the number was 25. This gives reason to believe that the maximum occurred last year. M. Wolff observing that a great many did not come from the constellation Leo, concludes that the periodical meteors are unconnected with the sporadical ones.

The Academy proceeded to the nomination of the commission for drawing up the list of candidates for the chair rendered vacant by the death of M. Civiale, the Section is composed of two members of the Section of Mathematics, MM. Mathieu and Becquerel; two members of the Physical Science Section, MM. Lecaisne and Longet; two free Academicians, MM. Leguin and de Verneuil; under the presidency of M. Chevreul. The chances are in favour of Dr. Larrey.

M. Chasles made a further communication on the subject of the Pascal-Newton forgeries.

M. Chasles also communicated the translation of a memoir of an American astronomer, M. Simon Newton, with respect to the parallax of the sun. He gives it at 8·56; M. Leverrier adheres to 8·95, a value which agrees with that determined by M. Foucault.

F. MOIGNO.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, NOV. 19, 1867.

Curious Terrestrial Globe.—Organisation of the Imperial Observatory—Report on Mr. Fryer's Concretor.—New Optical Instruments.

DURING the revolution of 1793 a curious terrestrial globe existed in the Royal Chateau de Bellevue. Becoming national, it was sold and bought by one named Testu. The latter person, after having lost his fortune, and not having room for it, deposited it in the Royal Library of the Rue de Richelieu. Later, M. Jomard, conservator, engaged M. Sanis to purchase this curious work, assuring him that, after being restored, the Government would purchase it for one of the museums. M. Sanis treated with M. Testu, and M. Jomard put him in possession of this globe so remarkable in an archæological point of view,

and he has had it since 1846. The globe has remained, after being restored, so as to have lost nothing of its primitive character, in the hands of M. Sanis, who wishes to yield it to a museum in any country. It can be seen at No. 22, Rue des Fossés, Saint Jacques, Paris.

As to the origin of this globe, the works of Guache gave the idea to Edme. Montell of constructing a globe which would represent at the same time the natural and political divisions of the earth. In order to accomplish this double project, the inventor proposed to trace on an ordinary globe, three feet in diameter, all the details of the inequalities of the surface of the globe. The King, Louis XVI. (so says the "Universal Biography of Milan"), ordered the execution of this project at the expense of £1,200, defrayed by his Majesty.

This instrument consists of—1. A great outer globe divided into two hemispheres. The convex portion gives the political geography, and the concave portion the state of the heavens. 2. A globe in relief, a mètre in diameter, rolls in the interior of the first, and represents continental and submarine mountains, basins, &c.

The decree for the organistion of the Imperial Observatory, dated January 30, 1854, contained the following:—"Every two years, at least, the minister receives a report stating the actual scientific situation and requirements, drawn up by a commission composed of two members of the Admiralty Board, a member of the Institute, two members of the *Bureau des Longitudes*, an inspector-general of superior instruction, and the director of the observatory. This excellent arrangement has remained a dead letter, the result being the enormous abuses whose extent can be known from the following facts. 1. The number of titular astronomers, calculators, and clerks, &c., who have passed through the Observatory without remaining in it between the years 1854 and 1867, exceeds a hundred. 2. Among those who have quitted the observatory there are many celebrated scientific men. 3. Several titular astronomers, the salaries of which ranged between £240 and £360 per annum, do the not perform any regular service. 4. That the amount of the salaries was fixed in the most arbitrary manner. 5. That the salaries of many astronomers were kept back even more arbitrarily. 6. That the future career of 6 or 7 pupils, of great merit, proceeding from the Ecole Normale of France, was seriously compromised by the engagements towards them not being carried out, &c. The minister of public instruction, being struck by this state of affairs, has named a commission to report on the state of the Observatory. Among the questions to be debated is the demolition of the present building and the construction of a new one.

M. Dubrunfaut has just made a report on his examination of the products obtained by the concretor of Mr. Fryer of Guadaloupe. He states that the mass is sufficiently ripe, and the crystals sufficiently detached to allow of refining processes being adopted, either by moulds or by the turbine. Its colour is inferior to the 4th class of good quality; and, observing the facility with which the syrup is displaced in the mass, he asks if the specimen which has arrived in Europe is the same as that which left Guadaloupe, or, in other words, if it has not been subjected to some purification which had sensibly altered its constitution. This species of cooked mass, in fact, does not appear homogeneous, and he thought it useful to reduce it to fragments, so as to mix them all together, and thus form a mass representing the true average.

The reporter first examined a colonial sugar classed as good 4th (No. 12 of the samples); the results are as follows:—

	Percentage.
Saccharimetric	91·35
Sugar (uncrystallisable)	3·65
Water	3·63
Ash corrected by the factor, 0·9	0·85
Organic and non-saccharine matters	0·55
	100·00

The return of this sugar by refining is accomplished in the following manner:—Admitting 3·73 for the saline co-efficient, as we also do for the indigenous sugar, and taking unity for the glucosic co-efficient, as several refiners of Paris adopt—

$0{\cdot}85 \times 3{\cdot}73 = 3{\cdot}17$ sugar
$3{\cdot}65 \times 1{\cdot}30 = 3{\cdot}65$
Sugar remaining in the molasses = 6·82
Sugar (refined) .. 91·35 − 6·82 = 84·53

Thus we have—

Crystallisable sugar	6.82	
Glucose	3·65	15·47
Water	5·00	
Refined sugar		84·53
		100·00

As the molasses are delivered by the refiners at 42° Beaumé, and at 50 per cent in all sugars, the return in molasses would be greater. But the difference compensates the loss, and the refiners ordinarily count upon cent per cent of return.

We can estimate the value of the sugar, in refining, as follows:—

	f. c.
84·53 loaf sugar at 1·25 f. the kilo.	106 66
15·47 molasses at 26 f.	4 02
	11 068

To be deducted

Duty on No. 12, less the drawback of 39f. Expenses of refinery 9·75 the 100 kilos., taking into account the return in molasses—8·25	47·25
Leaving	63·43

for the value in refinery, not including the profit of the refiner. This profit, given by the refining of ordinary sugars, can sometimes attain 8 or 10 fr. per 100 kilos. of the refined sugars, whilst the profit upon the white grained sugar is often negative.

The following is the result of the examination of the Fryer concreted sugar:—

Crystallisable sugar as ascertained by the saccharometer	78·00
Uncrystallisable sugar (Barreswill process)	9·10
Ash	2·80
Water	7·70
Other organic matters	2·40
	100·00

The returns of the sugar in Parisian refinery, calculated on the same basis as the good 4th above mentioned, give the following results:—

2·80 ash × 3·73	10·4 sugar
9·10 glucose × 1	9·1
Total	19·5

sugar contained in the molasses.

Thus we have, as a maximum, in molasses	42
Extractible sugar	58
	100

This return may be valued in Paris (not including the profit of the refiner) as follows:—

	fr. c.
58 kilos. of loaf sugar, at 1·25 fr.	72 50
42 kilos. of molasses	10 92
Total	83 42

To be deducted, we have

Small duty, less the drawback, 37fr. Expense at 20f. the 100 kilos. refined, 11·60 f.	47 60
Remaining for the value of the sugar	35 82

As a like produce would give relatively four times more molasses in refining than the average actual process, it would soon encumber the material with low produce, and would thus hamper the normal production. Several Paris refiners refuse systematically the purchase of every sugar producing more than three per cent of dross, that is to say, more than twenty per cent of molasses. What is to be done with those which give more than 40 per cent? It is probable that, in such a case, they would not consent to pay for this produce more than twenty to twenty-five francs the 100 kilos. in depôt, although this sugar can render by refining the 35·82 francs above calculated.

If we wish to know, after the composition of concrete sugar and good 4th, what would be the return in concrete sugar No. 4 and molasses, we arrive at the following result:—

Extractible sugar calculated	58 per cent
Molasses	16
Or in good sugar No. 4	74 per cent
In Colonial Molasses	26
	100

The above 74 kilos. are worth, in Paris, 46·9 francs, to which must be added the value of 26 kilos. of colonial molasses; considering that the 74 kilos. of good 4th have paid less freight than 100 kilos. of Fryer concrete sugar, it is plain that there will be more profit in making good ordinary or white sugar at the Antilles, than in making the Fryer concreted sugar.

In fact, in a fiscal point of view, 100 kilos. of Fryer concrete sugar having paid a duty of 37 francs, and only producing in reality 58 per cent of refined sugar, the 100 kilos. of refined sugar thus produced are burdened with a tax of 63·80 francs, while the loaf sugar is only valued at 47 francs.

The same calculation applied to the good 4th does not burden the 100 kilos. with a tax exceeding 43·13 francs, that is to say, 16·67 francs less than the sugar of the concretor. M. Dubruntaut does not recommend the adoption of the Fryer system into the French colonies, where the sugars are poor in refined sugar and rich in molasses, but he thinks it well adapted for the Antigua sugars. The sugars imported into England have given the following analysis in 100 parts: crystallisable sugar, 87·79; fruit sugar, 6·00; refuse, 0·81; water, 4·40, organic mater 1·00. A similar sugar assayed in Paris by the refiners gave on the same bases as those we have given above furnished: extractible sugar 78·7, molasses 21·3 in 100 parts.

M. Robert Houdin has just published a very interesting pamphlet on new instruments suitable for the observation of the different organs of the eye, also the manifestation of entoptic images. These are the names given by him to the shadows thrown on the retina by intra-ocular bodies.

Seven instruments of this class have been invented by M. Robert Houdin; these are: 1. The *Iridoscope*, fo the manifestation of entoptic images; 2. The *Diopscope* by the aid of which the inversion of the images on the retina are determined; 3. The *Pupilloscope*, demonstrating in a magnified form the dilations and contractions of the pupil; 4. The *Pupillometer*, which gives the diameter of the pupil to within a quarter of a millimètre; 5. The *Diopsimeter* for measuring the extent of the field of vision; 6. An *Optometer* for the use of any persons who wish to determine the distance of distinct vision; The *Retinoscope*, an instrument with which one can see the vasicular group, in his own eye.

F. Moigno.

CHEMICAL NOTICES FROM FOREIGN SOURCES

Melilotic Acid.—C. Zwenger. Melilotic acid, which is found in *melilotus officinalis* partly in the free state, partly combined with cumarin, belongs to the salicylic acid series. When fused with potassic hydrate hydrogen is evolved and salicylic and acetic acid formed. Heated in a retort, two equivalents of water separate and melilotic anhydride, $C_{18}H_8O_4$, distils over. The acid is monobasic but diatomic; its salts mostly crystallise well. Dibrom-melilotic acid, $C_{18}H_8Br_2O_6$, is obtained by adding bromine slightly in excess to melilotic acid at ordinary temperature. This acid is crystalline, sparingly soluble in water, readily in alcohol or ether. The action of strong nitric acid gives rise to the formation of dinitromelilotic acid, $C_{18}H_8(NO_4)_2O_6$. Melilotamide,

$$\left.\begin{matrix} C_{18}H_8O_2 \\ H_3 \end{matrix}\right\}\begin{matrix} O_2 \\ N \end{matrix}$$

is formed by treating melilotic acid with ammonic hydrate. Melilotic acid may be prepared artificially from cumarin by joining to the elements of the latter first two equivalents of water (converting it into cumaric acid), and then two of hydrogen:

$$C_{18}H_6O_4 + 2HO + 2H = C_{18}H_{10}O_6$$

This reaction is accomplished by treating cumarin in aqueous solution with sodium-amalgam.—(*Ann. Chem Pharm. Suppl.*, v. 100.)

Erucic Acid, Derivatives of. — O. Kausknecht. Erucic acid was prepared by treating beet-root oil (Ruböl). with plumbic oxide, extracting the lead soap with ether, and decomposing the remaining plumbic erucate with chlorhydric acid. The action of alcoholic potassic hydrate upon erucic dibromide under pressure and 140°—150°C., gives rise to the formation of behenolic acid $C_{22}H_{40}O_2$:

$$C_{22}H_{42}Br_2O_2 = 2HBr + C_{22}H_{40}O_2;$$

at ordinary temperature monobromerucic acid, $C_{22}H_{41}BrO_2$, is formed:

$$C_{22}H_{42}Br_2O_2 = HBr + C_{22}H_{41}BrO_2.$$

The dibromide of the latter, treated by this reagent loses two atoms of bromine, but whether monobromerucic acid is regenerated, or monobrombehenolic acid formed, has not been decided. Behenolic acid is soluble in water and in alcohol, and fuses at 57·5°; it unites with two or four atoms of bromine forming the bromides $C_{22}H_{40}Br_2O_2$ and $C_{22}H_{40}Br_4O_2$ (perhaps $C_{22}H_{38}Br_4O_2$). When heated with fuming nitric acid three bodies are obtained: 1. Dioxybehenolic acid $C_{22}H_{40}O_4$; monobasic, fusing at 90°—91°, insoluble in water and less soluble in alcohol than behenolic acid. 2. Brassylic acid, $C_{11}H_{20}O_4$; dibasic, scarcely soluble in water, soluble in alcohol or ether, fusing at 108·5°. 3 An oil, $C_{11}H_{20}O_3$, probably the aldehyde of brassylic acid, which may be converted into the latter by oxidation with bromine:

$$C_{11}H_{20}O_3 + H_2O + Br_2 = C_{11}H_{20}O_4 + 2HBr$$

Erucic dibromide treated with freshly precipitated argentic oxide is converted into an oily mass which is a mixture of liquid oxyerucic acid, $C_{22}H_{42}O_3$, and solid dioxybehenic acid, $C_{22}H_{44}O_4$, the latter being obtained as a bye-product. The reaction proceeds in the following manner:

1. $C_{22}H_{41}Br_2AgO_2 = AgBr + C_{22}H_{41}BrO_2$
2. $C_{22}H_{41}BrO_2 + AgHO = AgBr + C_{22}H_{42}O_3$

Oxyerucic acid is a heavy oil, insoluble in water, soluble in alcohol and ether. Dioxybehenic acid may be more readily prepared by boiling oxyerucic acid with an aqueous solution of potassic hydrate,

$$C_{22}H_{42}O_3 + KHO = C_{22}H_{43}KO_4$$

and decomposing the potassic dioxybehenate with chlorhydric acid. The acid is soluble in alcohol, and fuses at 127°. When erucic acid is boiled with diluted nitric acid it is converted into an isomeric compound, brassidinic acid, $C_{22}H_{42}O_2$, which is monobasic, fuses at 60°, and is less soluble in alcohol or ether then erucic acid. The dibromide of brassidinic acid is a crystalline compound, thus differing characteristically from the dibromide of the isomer, which shows no trace of crystallisation.—(*Ann. Chem. Pharm.* cxliii. 40.)

Copper, Determination of.—Lecoq de Boisbaudran. Instead of precipitating copper from solution, in presence of other metals, with zinc, the author proposes to effect its separation by means of an electric current. The slightly acid solution of the sulphates of copper and other metals is contained in a platinum crucible which forms the negative pole of an electric current from two of Bunsen's cells; the positive pole terminates in platinum foil, and passes through a perforation in a watch-glass which covers the crucible, dipping into the liquid. The copper separates in a perfectly pure state, and the reduction is accomplished in three or four hours. Intensity of current, concentration of solution, temperature, and amount of free acid may vary within wide limits without impairing the accuracy of the result.—(*Bull. Soc. Chim.* vii., 468.)

NOTICES OF BOOKS.

Geschichte der Chemie. Bearbeitet von Dr. Th. Gerding, *Leipzig*, 1867. (*History of Chemistry, by* Dr. T. Gerding).

This is a highly interesting and valuable contribution to the literature of chemistry. It is avowedly founded on the classical work of H. Kopp, published in four volumes in 1843-47; but it differs from it, not only in its smaller size, but also to some extent in its arrangement. Part I., which occupies nearly half the book, is entitled "General History of Chemistry; or, Historical Development of Chemical Science with respect to the most important Chemists and their Labours." This, the true history, is divided into four periods. The first, which may be distinguished as the ancient period, brings us down to A.D. 400. The second, the mediæval, extends to the 17th century, and is subdivided into separate histories of alchemy and of medical chemistry, which last may be said to have commenced with Paracelsus in the commencement of the 16th century. The third and fourth periods comprise modern chemistry. The former extends from the middle of the 17th to the end of the 18th century, and contains the reign of the celebrated phlogistic theory; while the latter, which occupies nearly one quarter of the entire book, is the "quantitative age," the short but brilliant career of true chemistry. This last section is particularly valuable to the modern chemist, for not only does it present us with succinct sketches of the lives and labours of the earlier chemists of the century, Lavoisier, Dalton, Gay Lussac, Davy, Berzelius, &c.; but it reviews with great impartiality, and, on the whole, with great exactness, the researches of many of the chief living chemists, and the English reader will notice with pleasure the names of Graham, Stenhouse, Anderson, Gladstone, and many other distinguished fellow-countrymen. We are indeed compelled to remark some glaring omissions, such as the absence of all notice of Andrews, Baeyer, Cannizzaro, Frankland, Odling, Zinin, and a few others of equal celebrity; but when we consider the extent of the plan and the smallness of the book, we cannot wonder at finding some blemishes.

The second part of the work is of even more practical importance. It is entitled "Special History of Chemistry; , History of the most important Doctrines, Theories, and ngle Substances." Under each head we find a clear though brief summary of the chief discoveries which have been made upon it. Thus under nitrogen (page 365) a very interesting account is given of the views which have at various times been taken, not only of the nature of nitrogen itself, but also of some of its chief compounds. We might give many similar instances, and should be glad, if space permitted, to give some extracts from the book. As it is, however, we can only commend it to the notice of our readers, and express our opinion that an English translation would meet with a favourable reception.

Pharmaceutical Chemistry. By John Attfield, Ph.D., F.C.S. London: John Van Voorst, Paternoster Row. 1867.

Dr. Attfield's Chemistry has for its object the thorough teaching of Pharmacy and Chemistry as applied practically to Pharmacy; professedly and indeed truly it is a guide-book. The information conveyed in the text is mainly that which cannot be learnt by experiment, such as the derivations of words and terms, the places whence different materials, pharmacal or chemical, are derived, with some of the various theories lately advanced upon the composition of somewhat complex drugs, *e. g.*, bismuthic carbonate, goulard water, and tarter emetic. The work being of the size of the British Pharmacopœia of 1867, and mainly founded upon it, forms, in many instances, a really invaluable commentary to it. Thus the symbolic expressions in the Pharmacopœia, called by courtesy the formulæ of compounds according to the new system, with their old names, (truly a most characteristic example of a compromise)—formulæ which are neither rational or empirical—with Dr. Attfield's aid are presented to the student in a somewhat more intelligible form. The expressions of the Pharmacopœia, such as $2(Bi_2CO_5)H_2O$, are here translated into a form reconcileable with the trivalent character of bismuth. The most modern expressions of chemists are used throughout the text, thus we meet with trivalent, &c., and equivalent is very well explained to the student as opposed to atoms and molecules.

We cannot, however, say that Dr. Attfield has had the same success in the consistency of his nomenclature. When new words like mercurous and mercuric salts are explained to the pharmaceutical chemist, who has to connect the ideas with compounds like calomel and corrosive sublimate, they should be strictly limited to metals like mercury, that have two classes of salts; other salts should have names consistent with their formulæ, or already familiar to the pharmacist or dispenser. Thus when the student reads of calcic carbonate and calic oxalate (p. 417), he compares them in his mind to mercuric carbonate, and mercuric oxalate, concluding justly enough that there is a calcous carbonate and calcous oxalate. This is more particularly the case, from the expressions, sulphate of calcium, carbonate of calcium, and nitrate of potassium being almost invariably used in the text. Again, under lead, there is no plumbous oxide, it being called oxide of lead, although plumbic peroxide is shortly after mentioned.

In our opinion the most valuable part of the work is that devoted to the preparations of the alkaloids and active principles, the most difficult thing that the student of *materia medica* has to learn. The *reason* for every successive process is given fully, and, what is more, accurately and clearly. The many excellent features of Dr. Attfield's book would have been increased had more attention been devoted to the spectroscope and saccharometer. To this might be added in a future edition a discussion of chemical organic compounds not actually mentioned in the British Pharmacopœia, but of the greatest value in full detail.

As it is, Dr. Attfield's book is written in a clear and able manner; it is a work *sui generis* and without a rival; it will be welcomed, we think, by every reader of the Pharmacopœia, and is quite as well suited for the medical student as for the pharmacist.

CORRESPONDENCE.

THE CAMPHOR STORM GLASS.

To the Editor of the Chemical News.

SIR,—The question put by your correspondent (p. 245) as to the origin of the oily looking layer sometimes seen at the top of the liquid column of the storm glass, admits of a ready answer. I have often noticed this oily looking layer. It is never formed, I believe, except when the glass has been exposed to the heat of the sun, so as to liquefy a considerable portion of the solid contents. These consist of nitre, sal-ammoniac, and camphor. The first two are taken up by the water of the composition, and the last by the spirits of wine, in quantities varying with the temperature. Now, while the tube is being warmed by the sun, a portion of the alcohol distils to the upper or air-filled part of the tube, and when the sun goes off the window and the tube cools, the vapour condenses into strong alcohol, the solvent powers of which for camphor are much greater than the spirits of wine originally employed. This alcohol, then, in settling down becomes saturated with camphor, and forms a well marked layer at the top of the liquid column.

This effect may be very well shown by the following contrivance :—Put into a long test tube a quantity of nitre or sal-ammoniac ; fill the tube one half with water. There should be more salt than the water can dissolve. Next put the tube into a gallipot containing warm water and standing on the hob. When the tube is quite warm, fill it up with strong camphorated spirit, leaving room for a well fitting cork and a little air. Shake up the contents and return the tube to its warm water bath. After a short time a well-defined oily looking layer, from two-tenths to five-tenths of an inch in thickness, will be seen at the top of the liquid column. If crude sal-ammoniac be the salt used the colour of this layer will be yellow passing into brown, due probably to a trace of iron in the salt. If pure nitre be used, the layer will be colourless. That this layer really consists of a very strong alcoholic solution of camphor may be shown by dipping into it a cold glass rod which will be quickly encrusted with solid camphor. If the tube be left to cool undisturbed small camphor stars will be formed, and circulate in regular order within the oily looking layer. The effects vary according as nitre or sal-ammoniac be used, but they are very pretty in either case.

This I believe to be the best explanation of the phenomenon in question. There is, however, a strong tendency to stratification in materials of such different densities, when in consequence of a gentle heat, such as that of the sun and of slow cooling, they are allowed to settle down. I have noticed three and even four distinct layers in a tube containing only nitre and camphorated spirit. If the storm glass be exposed to a fierce sun its contents will in cooling be so far separated that before the glass will act properly it must be inverted and shaken. It will then require a day or two of repose before its usual phenomena are exhibited.—I am, &c., C. TOMLINSON.

King's College, London, November 15, 1867.

MISCELLANEOUS.

Transparency of Molten Metals.—The assertion of Secchi, a few months ago, regarding the transparency of heated iron, has given rise to much talk ; but we have not yet seen it confirmed by the statement of any other competent eye-witness. Meanwhile, however, many assertions have been made as to the transparency of metals when melted; and the evidence on this point begins to stagger the *savans*. It so happens, that, so far as we are aware, no professional chemist or educated physicist has yet testified to the phenomenon as actually observed by him. It is merely said, in various quarters, to be a fact, well known to the workmen employed in melting and moulding certain metals. We deem it, therefore, important to mention the first authentic endorsement which has come to our notice. M. Paul Morin, the accomplished chemist in charge of the Aluminium Bronze Works near Paris, asserts that the melted alloy, when poured into the mould, is transparent ; and Mr. T. Sterry Hunt, to whom the assertion was made, and who saw the operation performed, assures us that the appearance of the molten stream seemed to corroborate the statement. There is a possibility of optical illusion in the inspection of a body which is itself intensely luminous, to discover whether it is transparent. We suggest that the question may be easily settled by the means employed to show the transparency of ordinary flame, namely, by burning magnesium, or in some other way producing a more brilliant light, behind it. The aluminium bronze is remarkable for two things, among other qualities, which distinguish it from ordinary alloys. One is the intense temperature developed by the union of the two metals, and the other is the extreme fluidity of the molten compound. Perhaps these qualities may be connected with the alleged phenomenon of transparency. Copper may also be transparent in the liquid state ; but, in pouring it into moulds, it often oxidizes very rapidly ; and the whole liquid mass is believed to be filled with disseminated particles of the red oxide of copper, which is opaque. Whether from this cause or not, we cannot say, but the evidence as to the transparency of molten copper, as likewise in the case of other metals, is still conflicting and inconclusive.—*American Journal of Mining.*

Composition and Quality of the Metropolitan Waters in October, 1867.—The following are the Returns of the Metropolitan Association of Medical Officers of Health :—

Water Companies.	Total solid matter per gallon.	Loss by Ignition.*	Oxidisable organic matter†	Hardness.		Organic and other ammonia.
				Before boiling.	After boiling.	
Thames Water Companies.	Grains.	Grns.	Grains.	Degs.	Degs.	Grains.
Grand Junction .	19·67	1·00	0·56	13·5	4·5	0·004
West Middlesex .	16·67	0·85	0·52	12·5	4·0	0·004
Southwark and Vauxhall.	18·50	1·00	0·59	13·0	4·5	0·004
Lambeth	19·00	1·25	0·60	13·5	4·5	0·004
Other Companies.						
Kent	27·50	0·75	0·26	18·0	7·5	0.000
New River . . .	17·00	0·25	0·31	12·0	3·0	0·001
East London . .	19·20	0·50	0·49	13·0	4·5	0·001
Surface Wells in City.						
Idol Lane (Church)	81·33	2·00	0·06	32·0	16·0	0·004
Leadenhall Street.	120·00	11·51	1·51	50·0	—	1·281
Dunning's Alley .	74·67	8·00	0·96	36·0	—	0·008

* The loss by ignition represents a variety of volatile matters, as well as organic matter, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

† The oxidisable organic matter is determined by a standard solution of permanganate of potash—the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

CONTEMPORARY SCIENTIFIC PRESS.

Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the "Chemical News."

Poggendorff's *Annalen der Physik.*
No. 6. 1867.

R. BUNSEN, "On the Temperature of the Flames of Carbonic Oxide and Hydrogen." A. TOPPLER, "Optical Studies by the Author's new Method." B. RIEMANN, "Contributions to Electrodynamics : On the Connection of the Laws of Electricity and Magnetism with those of Light and Radiant Heat." L. LORENZ, "On the Identity of Luminous

Vibrations and Electric Currents." C. Rammelsberg, "On the Phosphites." H. W. Schroder van der Kolk, "On the Mechanical Energy of Chemical Action." F. Zirkel, "On the Microscopical Constitution of the Phonolites."

Annalen der Chemie und Pharmacie.
August, 1867.

E. von Gorup Besanez, "Researches on Rhenish Beechwood Tar Creosote." E. Menzner, "On the Salts of Sulphophenic Acid." Glutz; "On some Chlorinated Derivatives of Phenol." Glutz, "A simple Method of preparing Chlorosalylic Acid." T. Meves, "On Oxyethylene-sulphurous Acid, and on a new Method of Forming Isathionic Acid." T. Meves, "Researches on some Salts of Cyanacetic Acid." R. Otto, "On the Bye-products obtained during the Preparation of Benzolsulphurous Acid." R. Otto, Note on the Preparation of Cyanurate of Sulphobenzide." H. Hubner, J. Ohly and O. Philipp, "On the Isomerism of the Aromatic Acids."

Journal fur Praktische Chemie.
No. 13. 1867.

G. Merz, "On a Method of Intensifying the Light given out by Sulphur when burnt in Oxygen. "An improved Method of Exploding Mixtures of Hydrogen and Oxygen." "A Method of showing the different Temperatures at which various Gases take fire." "An Instructive and Simple Experiment on Diffusion." "A Method of collecting the Products of Combustion of Gun Cotton, and of demonstrating the Presence therein of Peroxide of Nitrogen and Carbonic Oxide." "A Method of Demonstrating the Production of Carbonic Oxide during the Decomposition of Carbonic Acid by Incandescent Charcoal." "On the Behaviour of Carbonic Acid towards Water at High Pressures." "A Method of showing the Variation in the Illuminating Power of Flames when separate and when combined into One Light." "On the Combination of Hydrogen and Chlorine under the Influence of the Magnesium Light." "On the Use of Glycerine for Preserving the Gelatinous Mass obtained by treating Bone with Dilute Acids." "Apparatus for Showing the Igniting Points of Various Substances." "A Method of Preparing Starch Papers for the Detection of Iodine." "A Method of Demonstrating the Formation of Chloride of Sodium by the Action of Sodium on Hydrochloric Acid." "On the Property possessed by Bichromate of Ammonia of assuming, when heated, an appearance resembling Tea Leaves." "On the Chemical Toy known as "Chinese Grass Paper." "On the Increase in the Explosive Power of Gun Cotton and Gun Paper when Treated with Bichromate of Potash." "On the Fluorescence of Uranium Glass by the Magnesium Light." "On a simple Method of Preparing Ferrate of Potassium." "On a rapid Method of Preparing a Solution of a Salt of Manganese." "A Method of Distinguishing the Yellow Sublimate of Oxide of Lead from that of Oxide of Bismuth obtained on Charcoal before the Blowpipe." "An experiment showing the rapid Reduction of Heated Oxide of Copper to Metallic Copper by means of Alcohol." "On a Method of causing the Ignition of Illuminating Gas by Spongy Platinum." "On the Fluorescence of certain Coloured Glass when viewed by Reflected Sunlight." "A Method of Imitating Red Glass." "On a Method of showing the Different Colours of Solutions containing small quantities of freshly precipitated Gold." Boettger, "On the Crystallisation of Supersaturated Solutions of Acetate of Soda." "On a new and delicate Test for Alkalies and Alkaline Earths." "On some new Voltaic Batteries." "On the Occurrence of Teroxide of Thallium during the Electrolysis of Thallium Compounds, and on the Possibility of using that Body for the Manufacture of Matches." "On the Use of Solutions of Silicate of Soda for producing Arborescent Crystals of Metallic Salts." "On the Action of Lead on Distilled Water." J. Dogiel, "On the Presence of Volatile Fatty Acids in the Gall." G. Merz, "On the Volumetric Estimation of Acetic Acid." F. Gauhe, "Is the Product of the Action of Iodide of Phosphorus on Aqueous Picric Acid, Iodide of Pikrammonium, or Triamidophenol?

PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent. 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2919. J. Cubitt, Claremont Place, Brixton, Surrey, "An improved process and composition for the preservation from decay of stone, brick, plaster, metal, and other substances, and for hardening or glazing their surfaces, so as to prevent smoke or dirt from adhering to them."—Petition recorded October 17, 1867.

2997. C. W. Harrison, Oberstein Road, Clapham Junction, Surrey, "Improved means of preventing incrustation in boilers and other vessels in which water is heated."—October 24, 1867.

3051. G. Davies, Serle Street, Lincoln's Inn, Middlesex, "An improved mode of preventing incrustation in and removing it from steam boilers."—A communication from J. J. Allen, Philadelphia, Penn., U.S.A.,—October 30, 1867.

3064. W. S. Dixon, Bellisle, Ayrshire, N.B., "A new process of producing a blue dye or colouring matter."—October 31, 1867.

3105. J. Kidd, Paul's Wharf, London, "Improvements in obtaining artificial light, and in the apparatus employed therein."

3108. W. R. Lake, Southampton Buildings, Chancery Lane, "An improved artificial compound chiefly designed for use as a substitute for india-rubber or caoutchouc."—A communication from A. G. Day, Seymour, Conn., U.S.A., November 4, 1867.

NOTES AND QUERIES.

It has been represented to us that our column of Notes and Queries has occasionally been made the vehicle for the surreptitious disposal of trade secrets by subordinates in chemical works, unknown to their principals. This column has proved to be sufficiently useful to a large class of our readers for us to be reluctant to discontinue it for the sake of a few who abuse its privileges. Probably a more rigid supervision will enable us to obviate the difficulty. There will be no objection to a correspondent asking for information on trade subjects; but the answer must likewise be made public, and in such cases no name or address can be given, no private communications forwarded through us, and no offer of payment for information can be published

Clarifying Caustic Soda.—Would any of your correspondents be good enough to instruct me what method I must adopt to clarify caustic soda solution of the dark-brown substance, and other impurities, which are sometimes associated with it. When I make the solution and causticise with lime, the carbonate of lime falls to the bottom, leaving a solution, deeply coloured red or brown (instead of colourless and clear), which is exceedingly inconvenient.—George Johnson.

Granular Effervescing Citrate of Magnesia.—The medicine known as "Effervescing Citrate of Magnesia" contains no citrate of magnesia of the chemist at all. It is nothing more than citro-tartrate of soda of the British Pharmacopœia with an addition of sugar and four or five per cent of sulphate of magnesia. The magnesia can be detected by adding to a solution of the granules, ammonia, and tribasic phosphate of soda, when a precipitate of ammonio-phosphate of magnesia is almost immediately formed. The presence of the sulphuric acid in combination with this base can be detected by a solution of chloride of barium acidulated with hydrochloric acid, which gives an insoluble precipitate of sulphate of baryta.—C. Umney.

Granular Effervescing Citrate of Magnesia.—"A Surgeon" is quite right in supposing that there is no magnesia at all in the above preparation, indeed in many instances the two particular substances which are conspicuous by their absence are *magnesia*, and *citric acid* (!) while some varieties I have examined I found to contain bisulphate of sodium in place of the vegetable acid. One of the selast samples was "warranted to contain no acid besides citric," an assertion which was of course in one sense true. I have always believed that the absence of magnesia from the so-called "citrate" was "widely known," if not, the sooner the facts are published the better.—Wentworth L. Scott.

TO CORRESPONDENTS.

NOTICE.—The Printing and Publishing Offices of the Chemical News *will shortly be removed from Wine Office Court, Fleet Street, to*

BOY COURT, LUDGATE HILL, E.C.

P. Holland.—Received with thanks; we shall be glad to hear further from this correspondent.

J. Johnstone.—The article has been in type for several weeks. It shall be inserted as soon as we have room for it.

James O.—Precipitate the silver in a plate of copper.

Olinthus.—Mr. Campbell has detected arsenic in the beds of some rivers.

Chromo-technist.—An account of Mr. Sorby's researches on microspectroscopic analysis appeared in our columns some time ago.

A Subscriber.—We have asked the publisher for an explanation respecting the missing sheets in the Dictionary.

Communications have been received from Professor Weltzein; Yates; M. Murphy; T. Fox (with enclosure); Dr. Gilbert, F.R.S. (with enclosure); T. Bournes; T. Miller: W. Schofield; J. Smith (with enclosure); W. M. Bywater (with enclosure); Rev. C. W. Kett; F. Armstrong; W. Lovatt; J. Walkden; H. Russell (with enclosure); Professor Gustavus Hinrichs, Iowa (with enclosure); Dr. W. Allen Miller, F.R.S.; S. Wright; J. A. Brand; J. Samuelson; S. Chambers (with enclosure); W. Gillett; J. Brown (with enclosure; F. Bromley: W. Wingrove; Dr. R. Angus Smith, F.R.S.; W. Isbister; Dr. A. E. Sansom; F. O. Ward (with enclosure); J. Spiller; I. Baggs; Professor Gamgee; G. W. Simpson; H. Kinnaird Yorke; M. Moncreiff Pattison; C. R. C. Tichborne; S. E. Phillips (with enclosure); H. N. Draper; J. Cliff; Kingsbury & Co. (with enclosure); J. Heywood; W. Hall; Liebig's Extract of Meat Co.; Dr. Tilbury Fox; E. W. Bartlett; W. H. Harris; Dr. F. Wehelms; W. Hoe; C. Tomlinson.

Books Received.—"Mining and Scientific Press." "Scientific American." "American Artisan." "American Journal of Mining." "The Journal of Materia Medica." "The Journal of Gas Lighting." "Monitcur Scientifique." "The Colonial Mail." "The Produce Markets' Review." "Naquet's Modern Chemistry," translated by W. Cortis and Revised by T. Stevenson, M.D. London: Henry Renshaw. "A Programme of Atomechanics, or Chemistry, as a Mechanics of the Panatoms." by Gustavus Hinrichs. "The Microscope in Geology," by David Forbes, F.R.S. "The Bible and Science," by William Allen Miller, M.D., LL.D., Treas. and V.P.R.S. "The Darwinian Theory Examined." by a Graduate of the University of Cambridge. London: James Nisbet and Co., Berners Street.

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THE CHEMICAL NEWS.

Vol. XVI., No. 417.

ON GAS ANALYSIS.

By Drs. GRANDEAU and TROOST.

I. Mixture of Oxygen, Carbonic Acid and Nitrogen. —O, CO_2, N.

1. Introduce a portion of the mixture into a graduated tube over the mercury trough, and note accurately the volume.

To estimate the carbonic acid, pass into the tube, by means of a curved pipette, a small quantity of a concentrated solution of potash, and agitate several times until there is no further variation in the level of the liquid; the carbonic acid will be absorbed by the potash. To obtain the volume very accurately, transfer the tube to a vessel of water so as to allow the alkali to fall out; then retransfer the gas to another tube and determine its volume, saturated with moisture.

To estimate the oxygen, first introduce into the tube a concentrated solution of potash, then a little pyrogallic acid. Upon agitation, the oxygen is absorbed, and the nitrogen remains. The amount of the latter gas may be obtained by taking the same precautions as in the former instance.

After having determined the volume of carbonic acid, phosphorus may be employed to absorb the oxygen. The experiment may be performed in two ways.

a. In the Cold,—In the tube containing the gas (over mercury) pass up a long stick of moist phosphorus, the sides of the tube being at the same time moistened. The oxygen combines with the phosphorus, giving phosphorous acid, which dissolves in the water. At the end of an hour the absorption is completed. It may be known by the absence of white fumes on the stick of phosphorus. Remove the latter, dry the gas, and measure its volume; it will be the nitrogen.

b. With Heat.—The analysis is effected much more rapidly in the following manner:—In a curved tube containing the mixture of oxygen and nitrogen standing over water, introduce by means of an iron wire a small piece of phosphorus, so that it rests on the upper curved portion of the tube; then remove the iron wire and heat the phosphorus, at first carefully, to volatilise the water which remains in the bend of the tube, and then rapidly, so as to inflame the vapour of phosporus. A greenish flame will be seen to advance, gradually absorbing the oxygen of the air. When it has descended to the level of the liquid it disappears, and the experiment is terminated. Allow it to cool and determine the volume of the residual nitrogen.

2. The analysis of a mixture of carbonic acid, oxygen, and nitrogen may be effected with a little more accuracy in the following manner:—The dry mixture being contained in a graduated tube standing over mercury, introduce a piece of caustic potash fixed to the extremity of a platinum wire, and slightly moistened. When the carbonic acid is absorbed, withdraw the piece of potash, and a simple observation gives the residual volume of the mixed oxygen and nitrogen perfectly dry.

This residue is introduced into a mercurial eudiometer. This consists of a glass tube about 2 centimeters in diameter, having two platinum wires melted through the upper part terminating exteriorly in a loop, and curved inside in such a manner as to have their extremities opposite to each other, and one or two millimeters apart, across which the spark passes.

Add to the mixture double its volume of hydrogen, and pass the electric spark. Water will be produced by the combination of the hydrogen and oxygen in the proportion of two volumes of the former to one volume of the latter. One-third of the diminution in volume represents, therefore, the volume of oxygen. The volume of nitrogen is obtained by difference. It is the excess of the original volume of the mixture over the sum of the volumes of oxygen and carbonic acid.

The estimation of oxygen by the eudiometer is not exact unless this gas is present in tolerable quantity in the mixture. If there is only a very small proportion, it is necessary, in order to ensure complete combustion, to take the precaution to introduce into the mixture a sufficiently large quantity of oxy-hydrogen gas, obtained by decomposing acidulated water with three or four Bunsen's elements. The gas should be passed through concentrated sulphuric acid in order to dry it.

II. Mixture of Oxygen, Hydrogen and Nitrogen. —O, H, N.

1. After having measured the volume of the mixture, absorb the oxygen by potash and pyrogallic acid, or by phosphorus as described in section I.

Pass the remainder into a curved tube over mercury and introduce into it a piece of compact oxide of copper,* and heat it for about twenty minutes, all the hydrogen is then absorbed; the residue will be nitrogen: it may be transferred to a graduated tube, and its volume measured.

After the absorption of the oxygen the hydrogen may be estimated by introducing it into the eudiometer with half its volume of oxygen. Two-thirds of the diminution of volume occasioned by the passage of the spark represents the volume of hydrogen. The nitrogen is given by difference.

2. The analysis may also be effected entirely by the eudiometer. Introduce the original mixture into the eudiometer with twice its volume of hydrogen, and pass the spark. The volume of hydrogen which enters into combination will be two-thirds the diminution of volume, the oxygen being represented by the other third. This first experiment will therefore give the amount of oxygen. In order to ascertain the amount of hydrogen in the mixture, add to the residue of the first explosion half its volume of oxygen, and pass the spark a second time. Two-thirds of the diminution of volume will be hydrogen. The excess of the sum of the volumes of hydrogen burnt in these two experiments, over the volume of this gas introduced into the eudiometer, represents the volume of hydrogen found in the original mixture. The nitrogen will still be given by difference.

III. Mixture of Hydrogen, Carburetted Hydrogen, and Nitrogen.—H, C_2H_4, N.

Introduce the mixture into a mercurial eudiometer with twice its volume of oxygen, and pass the spark. The free hydrogen, and that in the carburet, combine with the oxygen to form aqueous vapour which condenses. The carbon becomes carbonic acid. The residue is therefore a mixture of nitrogen, oxygen, and carbonic acid.

Pass these gases into a graduated tube, and after having observed the volume, absorb the carbonic acid with potash. The diminution of volume gives the volume of carbonic acid, which is precisely equal to the volume of the carburetted hydrogen, as shown by the equation:

$$\underbrace{C_2H_4}_{4\text{ vols.}} + 8O = 4HO + \underbrace{2CO_2}_{4\text{ vols.}}$$

If a little pyrogallic acid is then introduced into the potash, the rest of the oxygen is absorbed, and the volume of nitrogen is obtained as a residue.

* M. H. Ste-Claire Deville prepares this compact oxide by fusing 2 parts of oxide of copper with 1 part of oxide of lead. The fused mass is run on to a plate of copper, then broken into pieces and preserved in bottles.

As to the hydrogen which existed in the free state in the original mixture, its amount is obtained by taking the excess of the volume of the original mixture over the sum of the volumes of nitrogen and carburetted hydrogen.

(To be continued.)

ON

SOME POINTS IN CHEMICAL NOMENCLATURE.*

By A. V. HARCOURT, M.A., Lee's Reader in Chemistry.

ONE of the dangers against which the advancing sciences need to be always on their guard is that of mistaking verbal for real questions. An example of this well-known truth is furnished by a controversy, which has been carried on among chemists in an intermittent fashion during several years, and which has recently broken out afresh.

The subject of the controversy is the question, What is an acid? As to the meaning of the name there is a tolerable agreement, though no chemist would attempt to state it with scientific precision. The only appeal is to the popular use of the word. By an acid, I suppose we mean a sour, corrosive substance, which changes vegetable colours, and effervesces with carbonated alkalies and is neutralized by them. At any rate an acid ought to have most of these properties. It has happened, however, that by a process very common in the history of scientific nomenclature, many substances have been likened, on other grounds, to those which this description applies, and have thus received the name of acid though devoid of these properties; while, on the other hand, many substances having all these properties are by common consent excluded from the acid class. But the controversy does not originate in this border land. It relates to some of the most typical and best known acids. Different chemists apply to different substances the familiar names of sulphuric acid, nitric acid, carbonic acid.

Formerly these names, which may be taken as examples of the class, were applied to particular oxides of sulphur, nitrogen, and carbon. But the founders of the unitary system of chemistry, laying stress upon the facts, (1) that these substances exhibited their characteristic properties only in the presence of water, (2) that some well-defined acids while having hydrogen in their composition were devoid of oxygen, transferred the name of acid from these oxides to their actual or supposed hydrates, and assigned to the oxides thus dispossessed the name of "anhydrides." This system having met with general acceptance among scientific chemists, the change of nomenclature has also been widely adopted.

Quite recently one of the foremost of English chemists, Dr. Williamson, in a manual published at the University Press, has reverted to the ancient practice, objecting to the name of "anhydride" as unmeaning, and insisting on the advantage of co-ordinating, in each series, hydrogen salts with metallic salts instead of separating them under a distinctive name. This retrogade proposal has naturally been controverted by the adherents of the prevailing system, and thus it is now more uncertain than ever what substance a chemist means when he speaks, for example, of sulphuric acid. All discussion, Gerhardt says, remains necessarily sterile when the disputants are agreed as to facts and differ only about the meaning of words. In this case, I venture to think the best solution of the controversy may be to discontinue the use of the word "acid" as a specific name for a particular class of substances, and to apply it only as a descriptive term to any substance having the properties which the word connotes. The name of oxide appears perfectly applicable to, and sufficient for, all those substances which have been called "anhydrous acids," and it appears positively mischievous to distinguish the acids from the other salts of a series. In order to determine what particular name these oxides and salts should receive, it is necessary to decide some much more general questions of nomenclature, as to which there is at present great difference of opinion among chemists.

I should exceed the limits I have undertaken to observe, if I attempted to offer a criticism upon the various names that have been proposed for these classes of substances, but I shall venture to state what names appear to me to be the best, and shall endeavour to offer some reasons for my conclusions. The name of "carbonic acid," for the substance whose symbol is CO_2, is perhaps too well established ever to be changed, but for a systematic name I should prefer "carbon dioxide;" and similarly for anhydrous sulphuric acid and anhydrous nitric acid I would substitute "sulphur trioxide" and "nitrogen pentoxide." To the salts of these acids, as they are called, I would give such names as "sodium carbonate," "nickel sulphate," "silver nitrate;" and the hydrated acids I would, upon the same principle, call "hydrogen sulphate," "hydrogen chloride," "hydrogen phosphate," &c.

Two sets of names are more familiar than these: (1) "binoxide of carbon," "sulphate of nickel," &c.; and (2) "carbonic binoxide," "nickelic sulphate," "hydric chloride," &c. To the first it has been objected that the use of the preposition "of" is incorrect, being in fact a too literal translation from the French. "*Carbonate de soude*" no more ought to have been rendered "carbonate of soda," than "*table de bois*" should be translated "table of wood." Accordingly chemists are now accustoming themselves to give up this usage which had acquired a formidable prescription. As to the second set of names, I see no advantage in adding the adjectival termination except where it is desired to prefix a numeral or to distinguish a class of salts by one or other of the terminations "-ic" or "-ous." In these cases, which are comparatively few, such terminations might be used without rendering it necessary to employ them in other cases. It is to be objected to them that they necessitate the use of Latin names in many cases instead of English, as "argentic" for "silver," or are tacked on barbarously to words which are not Greek or Latin, as in "nickelic," "zincic," &c. Further the special use of these terminations, to indicate which of two classes of salts contains the larger proportion of metal, causes some confusion when they are applied without any such meaning. For example, "calcic sulphate" corresponds in constitution to "ferrous" and not to "ferric sulphate." I would rarely attempt to indicate the formula completely by numerals introduced into the name, but would give as a rule the simple name of "chloride" or "oxide" to that compound which is normal according to the atomicity of the particular metal. Thus I prefer "sodium dioxide", to "disodium dioxide" for Na_2O_2. In a few cases it may be convenient to express more; thus the magnetic oxide of iron might be named "terferrum tetroxide." For the parallel series of tin, mercury, and iron salts respectively, the convenient designations of "stannous," "stannic," &c. may be retained, while each pair would naturally be represented by the simple name of the metal. Thus we might speak of the two "iron sulphates," "ferrous sulphate" and "ferric sulphate." A complex salt such as microcosmic salt might be called "sodium, ammonium and hydrogen phosphate." It appears to me clearly better to have a descriptive name of this kind thus divided into several distinct words rather than to attempt to form such a single word as "hydro-sodio-ammonic phosphate." I will only add that names with a numeral appear to me generally better than such vague terms as "peroxide" and "suboxide," and that as far as possible Latin numerals should be joined to Latin words, and Greek numerals to Greek words.

* Proceedings of the Ashmolean Society, New Series, No. 1.

ON THE DEVELOPMENT OF IDEAS IN NATURAL PHILOSOPHY. *

By JUSTUS VON LIEBIG.

(Concluded from page 263.)

We observe the influence of wealth upon the mind of the productive class in those commercial states whose trade originates with industry; the sons of the mechanics and merchants abandon the occupation of their fathers, the source of their wealth; their aim becomes the acquisition, not of money, which they possess in abundance, but of honour and distinction,—they devote themselves to science, to the service of the government, of the army, or the church, and in this manner from the productive rises the intellectual class.

In Europe a manufacture does not go down to the third generation, and, in like manner, mercantile houses pass in the second generation into other hands; therein consists in a free state the renovation of the whole industrial population with each generation, and the perpetual revival of industry,—the industrial grown rich makes room to the man without means, who aspires, and who produces new inventions, and thus a circulation is established in the state, by which its power and wealth constantly increase.

In Greece these relations were shaped in a totally different manner; there, as everywhere, wealth created the intellectual class of society, whose subsistence must be secured by the productive class; but the latter did not renovate and recruit itself in Greece; the free man without means was obliged to emigrate, he might possibly invent a machine, but he could not invent slaves, and without slaves he was debarred from acquiring wealth by industry in his country; the way of trade remained open to the minority only.

As soon as the circulation which preserves industry ceased in the state, and the power of production in the population, upon which its progress depends, Greece had arrived at the limit of her civilisation and culture. The rich people did not produce any further inventions, and with the absence of new facts gained from nature, dried up the source of the ideas indispensable to the enlargement of the domain of the mind, *i.e.*, the culture. The trade in home productions must by degrees pass over into the trade in products of other countries; by this means the accumulated capital could still for a time be saved, but the sinews of life of the slave state withered, for centuries before its decline became visible by outward marks.

The civilisation of the Greeks travelled by the Roman Empire and by the Arabs, into all countries of Europe, and its continuous development became manifest throughout the middle ages in the increase of inventions. At the end of the 15th century we already meet with higher algebra and trigonometry, the decimal divisions in calculations, the improved almanac, and in the field of medicine a complete revolution prepared; we find admirable progress in mining and in the metallurgical processes, in dyeing, weaving, and tanning, in the art of making glass, in engineering and architecture, and especially in the sphere of chemistry, paper, the telescope, fire-arms, watches, knitting with knitting-needles, table-forks, horse-shoes, bells, fire-places, and chimneys, the arts of wood-cutting and copper engraving, wire-drawing machines, the manufacture of steel, plate-glass, tinning of mirrors by lead and tin amalgam; wind, saw, and crushing-mills were discovered, and corn-mills, and the loom were improved.

These inventions give an idea of the progress of civilisation in Western Europe, and with these and the geographical discoveries all acquisitions in the realm of mind in the 15th century are closely connected; we find a flourishing trade which embraces the whole of Europe from Geneva, Pisa, and Venice, to the coast towns of the German Ocean and the Baltic, and which connects Europe with the East, Arabia and India, and as its foundation we find an extensive industry in the thriving Flemish, Italian, German, and English towns; we observe in these towns a free opulent citizenship rise in increasing ability, and out of the civic elements the intellectual class of society naturally rises in consequence of accumulated wealth. From here commences the development of Greek and Roman culture.

At first the faculties of the newly originated learned profession were expended in endeavours to take possession of the inheritance of the intellectual treasures bequeathed by antiquity, and as long as the scholars had to learn and were disciples themselves, and the Greek and Roman culture was not yet alive in them, *i.e.*, not capable of being further developed, so long they could not fulfil their avocations of becoming teachers of the people. They even turned away, and not without reason, from the people and their language, for the literature of their country scarcely offered anything worthy to attract and engage their mind filled with the models of antiquity.

The position and the occupations of the scholars of that time co-operated in excluding them from intercourse with the productive classes, and the literature of that period therefore does not give us any information as to the degree of civilisation and culture of the people; the knowledge circulating in the population and penetrating into their thoughts, and developing itself from the better acquaintance with the physical laws and in proportion to the sum total of their more correct ideas of things and their relation to each other, had not yet been collected in books, and was totally unknown to the scholars.

The approximation of the intellectual and productive class was scarcely retarded by the seclusion of the learned profession, because the trading and industrial population up to the 14th century were without the necessary medium in the but little accomplished language of books. In lieu of the scholars the master singers worked successfully in their schools of music for the development and diffusion of the language by voice and pen amongst the civil classes; hitherto the productive class was limited in the exchange and increase of their experience exclusively to personal intercourse by travelling, they were a wandering class of society; but with the acquisition of the language of books the facts and experience gained by them were collected and became diffusible, and writing and reading, hitherto unknown arts, were recognised by the population as highly necessary means to exchange and increase their knowledge,—at first in the towns whose industry was not compatible with a wandering population. In these towns the first public schools were founded; the ardent desire to spread the treasures of antiquity by schools was, with the learned class, just as strong as the longing for instruction with the productive class. Both circumstances combined increased the demand for books, and the difficulty to meet this demand by copyists called forth in the middle of the 15th century the invention of printing.

A century before it would have been without the slightest influence upon the development of the mind: from the time at which it took place dates a new era in the history of culture.

In looking over the literature at the end of the first century after the printing of the first book with moveable letters, one is filled with astonishment at the extent and importance of what was accomplished in natural science and medicine, and at the extraordinary mass of facts and experiences which the middle ages had acquired and handed down in astronomy, technics, engineering, in handicraft, and industry, and which were now collected

* A Lecture delivered at the Meeting of the Royal Academy of Science, at Munich.

by those intellectually educated scholars of the high schools, which stood nearest to the productive classes, the medical men. In the 16th century the medical men were the founders of the modern natural sciences. They were the media of the intellectual education of the people. But again a century and a half elapsed before the knowledge collected and acquired by them was sufficiently arranged—sufficiently extensive and complete to become effective as a means of instruction in the universities; until then the foreign language in which their knowledge was deposited, and which was familiar to all scholars of Europe, had the advantage, which cannot be too highly estimated, of combining for the solution of their high problems all men of all European countries who devoted their energy to the promotion of science. Without the Latin language in common, their fruit-bearing co-operation would have become impossible. Only towards the end of the eighteenth century, fell, with its exclusion from science and literature, the last barrier which had separated the intellectual class from the productive. Both spoke again, as in ancient Greece, the same language, and understood each other, for science, school, and poetry co-operated to spread an equally high degree of education in all classes.

With the extinction of slavery in the Old World, and the combination of all elements further to develope the human mind, advancements in civilisation and culture were initiated, which are without end, indestructible, and imperishable.

In natural philosophy a change has taken place in the course of its cultivation. For some time this science had been supplied with all facts from which it formed by mental labour the derived ideas, by metallurgists, engineers, apothecaries, the industrial class generally, and natural philosophers had reduced their inventions to ideas which the manufacturing class received back in the shape of explanations and turned to profitable account.

The antipathy of the practical class to theory died out. The artisan, manufacturer, agriculturalist, the medical man, consult, as formerly in Greece, the scientific theorists. A new impetus was given to science as soon as the scientific investigator—the teacher of medicine—had acquired the technical skill and dexterity of the practical class, and when, on the other hand, the productive class had adopted the laws and scientific principles laid down by the scholars. Thus the man of science has become an inventor, and is independent in the prosecution of his studies. The manufacturer, the agriculturalist, has become an independent investigator, an intellectually free man.

A picture full of life, of endless activity, wide in results, unfolds itself before our view into the future. The past now appears to us in a different light. We look back with indifference at the conflicts between mediæval scholastics and ecclesiastics upon natural philosophy; their opposition was based upon the incapacity of distinguishing at that time between a hypothesis and a fact. All the ecclesiastical and secular power united could not prevent the invention of the telescope and the compass, and the discovery of oxygen, and could not suppress their reaction upon the human mind. A book may be burned, but not a fact.

With the proof of the earth being a small planet revolving round the sun, the former conception of "Heaven," and with the explanation of fire, the conception of "heat" lost its significance; with the discovery of atmospheric pressure, the belief in witchcraft and sorcery lost its foundation, for with the "dread" of a vacuum, nature lost her "will," her love, her hatred. With these discoveries man began to feel his power and his position in the universe.

If Aristotle and Plato had risen alive from their graves and had become teachers in the scholastic institutions of the middle ages, they could not have furthered the progress in science for want of increase in derived ideas. The logic of the scholastics and the intellectual gymnastics raised upon it, were only adapted to their times and those which succeeded them; their hostile position to natural philosophy had no influence upon its progress.

And if the whole church and state power had been in league with the natural sciences, still the latter would not have advanced a single step, and would not have developed itself either sooner or in a different manner.

If we were to calculate the influence upon our time and our position which Luther effected, in conjunction with the great discoveries in the field of nature, and also the influence which these discoveries would have had without Luther, we should arrive at a peculiar result. We now know that the human conceptions are organically developed according to certain laws of nature and of the human mind, and we see the tree of human knowledge planted by the Greeks grow in the soil of civilisation, and by our care of the soil we see it develope itself without interruption, and blossom in the sunshine of freedom, and bear fruit in proper time. We have learnt that by external force its branches may be bent but not broken, and that its delicate and numberless roots lie so deep and hidden as to withdraw their silent working altogether out of the reach of human will and pleasure.

The past history of nations informs us of the impotent endeavours of political and ecclesiastical powers to perpetuate the bodily and intellectual slavery of men. The history of the future will record the victories of liberty gained by men by inquiring into the essence of things and into truth—victories gained with weapons not stained with blood, and in a combat in which morality and religion will take part only as feeble allies.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, November 21.

WARREN DE LA RUE, Ph.D., F.R.S., President, in the Chair.

THE minutes of the previous ordinary meeting were read and confirmed, and the donations to the library announced.

The PRESIDENT then read a letter of acknowledgment written by Mrs. Faraday in answer to the address of condolence which was forwarded to her agreeably to the resolution passed at the last meeting. The names of candidates proposed were—Mr. Alfred E. Fletcher, Inspector of Alkali Works, Johnston, near Prescot; and William Frank Smith, M.D. Lond., Lecturer at the Sheffield School of Medicine, Glossop Road, Sheffield. For the second time were read the names of Thomas Hall, B.A. Lond., Lecturer on Chemistry and Natural Philosophy at the City of London School; Charles Walter Maybury, Teacher of Chemistry, 90, King Street, Manchester; George Lunge, Ph.D. (Breslau), 10, Albert Terrace, South Shields; Facundo J. R. Carulla, Chemist to the Atlas Steel and Iron Works, 59, Gell Street, Sheffield; and Alexander Crum Brown, M.D., Lecturer on Chemistry, 4, Rillbank Terrace, Edinburgh. The name of Charles Meymott Tidy, M.B., of the Hollies, Cambridge Heath, Hackney, was read for the third time.

The President gave notice that the next meeting of the Society, December 5, would be made general for the purpose of considering and taking action upon the proposal to alter the first by-law relating to the election of Fellows. The law at present stands thus :—

"Every candidate for admission into the Society shall be proposed according to a form of recommendation (No. 1, appendix) subscribed by three Fellows of the Society, to one, at least, of whom he should be personally known, and such certificate shall be read and suspended in the Society's rooms, or place of meeting, for three ordinary meetings."

It was now proposed to require the names of five members (instead of three) subscribed on the form of recommendation, to three of whom (instead of one) the candidate should be personally known. With respect also to the printed form of recommendation, it was suggested to modify the phraseology to "name;" and (in second line) "qualification or occupation, if any."

Mr. E. T. Chapman made a statement on "*The Relation between the Results of Water Analysis and the Sanitary Value of the Water.*" Much has been said and written upon the proper method of performing water analysis, but comparatively little attention has hitherto been given to the interpretation of the results, and thus it happens after determining the ammonia, nitrates, phosphates, &c., the reporter usually appends to his analysis an opinion stated somewhat as follows :—"This water is perfectly harmless;" or, on the other hand, "exceedingly deleterious." The speaker's object was to fix a standard according to which the chemical quality of any given sample of water was to be judged. A good drinking water should not contain any appreciable amount of ammonia; lime salts communicate "hardness," but are not directly injurious to health; water containing nitrates in solution, but otherwise pure, was also harmless; if, however, these several ingredients occurred together in a water, the conditions were favourable to the development and growth of the lower forms of vegetable life, and such water kept in a cistern quickly assumed purgative properties. Mr. Chapman has made experiments upon pigeons, and found that when the birds were supplied with water of the last named quality, they were purged almost to death, and when the water was changed to a pure sample, or such as contained any one of the above ingredients alone, they soon rallied. These results were confirmed by experiments on the human system, and the author argued the necessity of observing the relations between the several ingredients in a water before pronouncing upon its sanitary value. The extended use of Clark's process was recommended as a means of removing the most objectionable forms of organic matter contained in waters holding in solution the carbonate of lime. A small proportion of impure water, such as that drawn from certain pumps in the City of London, was sufficient to start the decomposition and render unwholesome large bulks of Artesian water with which it was mixed. The quality of the water raised from the well in the Bank of England was such that, after storage in tanks, the colour became quite green, and the vegetable confervæ accumulated to such an extent as to choke the delivery pipes. Considerable amounts, both of ammonia and nitrate, existed in this water.

The President referred to the well water in Golden Square, which bore so bad a character in times of cholera visitation, as an example of a perfectly clear water having a pleasant flavour without any sign of desmidieæ or other species of vegetable organisms. This water contained nitrates and carbonate of lime, but its deleterious character was supposed to be due to decomposable organic matters existing in solution.

Mr Dugald Campbell said there were a great many wells about London supplying water pleasant to the taste, and containing 30 or 40 grains to the gallon of nitrates and nitrites. When an outbreak of cholera occurred the wells were closed. In Lincoln's Inn Fields were two water mains, marked S and H (*i.e.*, *soft* and *hard*); the first was New River Water, and the other possessed a degree of hardness amounting to 50 of Clark's scale, and contained a large quantity of nitrate. Instead, however, of its being purgative the use of the water had the opposite effect.

Dr. Stevenson had occasion to examine a supply of water of which cholera patients had partaken. He could not find in it any infusoria or other kind of pseudo-vegetable matter, nor products of their decomposition. The general opinion of physicians was adverse to the introduction and use of a water containing but a very small proportion of carbonate of lime.

Mr. Spiller referred to the treatment of Kent water by Dr. Clark's process as now conducted at the Herbert Hospital, Woolwich. The softened water was found to differ in a remarkable manner from the original supply by its not permitting the growth of vegetable organisms.

Mr. Campbell observed similar results many years ago with the softened water formerly supplied by the Plumstead Company.

Mr. Chapman said that Dr. Clark's process was still being carried out at Caterham, and that by its use fully six-sevenths of the nitrogenous organic matter present in a water might be removed by the precipitated carbonate of lime.

Professor Abel considered that the germinal inactivity and flat taste of the lime-softened waters were simply due to the removal of free carbonic acid. Organic matter was no doubt partially precipitated together with the carbonate of lime as a kind of lake, but that portion which remained in solution would eventually make its existence manifest when a re-absorption of carbonic acid from the air should have occurred.

The President in moving a vote of thanks, took occasion to refer to a successful instance of well-sinking by the American system, whereby he obtained a supply of good water at the rate of fifteen gallons per minute. This was accomplished by driving into the earth 1¼ inch pipes shod with steel, which could be lowered twenty feet into hard gravel in the short space of three hours, a weight, or "monkey," of 70 lbs. being let fall upon the upper extremity of the tube.

Dr. J. H. Gladstone then read a paper "*On the Pyrophosphoric Amides.*"

The author stated that in former communications he had described three acid bodies that may be viewed as pyrophosphoric acid, in which one, two, or three molecules of amidogen have displaced an equal number of molecules of hydroxyl. Their composition and their relation to the original acid may be thus exhibited :

Pyrophosphoric acid	$P_2H_4O_7$
Pyrophosphamic acid	$P_2(NH_2)H_3O_6$
Pyrophosphodiamic acid	$P_2(NH_2)_2H_2O_5$
Pyrophosphotriamic acid	$P_2(NH_2)_3HO_4$

Since these papers were written he has come across some additional facts, and has formed a more precise conception of the rational formulæ of these bodies.

Pyrophosphamic Acid.—This acid had hitherto been formed only by the breaking down of the higher amide, but the author gave reasons for believing that it might be prepared synthetically. When the pyrophosphate of an earth or metal is prepared in the presence of ammoniacal salts, the precipitate when heated *per se* gives off ammonia and a peculiar sublimate, which is supposed to be characteristic of a pyrophosphamate. The ferric salt, however, differs from the ordinary ferric amate in being more soluble, and in being easily broken up by acids, and it was never obtained pure for analysis.

Pyrophosphodiamic Acid.—The author had previously published a characteristic test for this acid, founded on the fact that when a solution containing it is rendered strongly acid, and is heated with a few drops of a ferric salt, the flocculent white pyrophosphamate makes its appearance. But a chemist inexperienced in these compounds might easily be misled by the formation of the

insoluble ferric pyrophosphate, especially if the solution is not very acid. Hence it will be generally desirable, if not necessary, to dry a portion of the precipitate, and examine which compound it is by heating it *per se* in a test-tube, when the pyrophosphate simply fuses, and the pyrophosphamate does not fuse, but turns black at first, and gives off ammonia and a little white volatile salt. Still, as the proof that this acid may be prepared by the eleven methods noted in his paper, rests mainly on the evidence of this test, the author thought it well to repeat the principal experiments, examining whether it was the amate that was really produced. He has found it to be so in all cases; and has no reason to doubt that in each instance it had been formed by the decomposition of pyrophosphodiamic acid.

Pyrophosphotriamic acid.—The method formerly given for preparing this body was not a productive one, and the acid was apt to be contaminated with another compound, unless great attention was paid to the temperature. The following is a far more productive and a better process:—Saturate oxychloride of phosphorus with dry ammonia gas, without regard to the rise of temperature, heat the resulting mass at about 200° C., add water to it, and boil for about a minute. This will convert the whole of the insoluble portion into triamic acid, with very little loss from the production of other phosphoric compounds. This acid has also been met with among the products of decomposition of one of the tetraphosphoric amides that remain to be described at some future time.

Theoretical Constitution.—In his last communication the author suggested as the rational formula of pyrophosphoric acid, $P_2(HO)_4O_3$, or at greater length,

$$\left.\begin{matrix}P(HO)_2O\\P(HO)_2O\end{matrix}\right\}O;$$

and he expressed his conviction that when this acid is produced by the mutual action of water and oxychloride of phosphorus, the two atoms of hydrogen in the molecule of water are attached simultaneously by two molecules of the chloride, and the water type is preserved in the new phosphorus compound.

The same principle was applied to explain the reactions by which these pyrophosphoric amides are formed, especially the symmetrical pyro-diamic acid; its rational formula will be

$$\left.\begin{matrix}P(NH_2)(HO)O\\P(NH_2)(HO)O\end{matrix}\right\}O$$

The unsymmetrical pyro-amic and pyro-triamic acids will be respectively,

$$\left.\begin{matrix}P(NH_2)(HO)O\\P(HO)_2\quad\ O\end{matrix}\right\}O, \text{ and}$$

$$\left.\begin{matrix}P(NH_2)_2\quad O\\P(NH_2)(HO)O\end{matrix}\right\}O.$$

A vote of thanks having been passed to Dr Gladstone, the President adjourned the meeting until Thursday, December 5th, when Mr. W. H. Perkin would read a paper "*On the Artificial Production of Coumarine and its Homologues.*"

The following report has been forwarded to every member of the Chemical Society:—

Sir,—At a meeting of the Council, held on May 16th, 1867, it was resolved, "That a Committee of five be appointed to consider the by-laws relating to the election of Fellows, Honorary Members, and Associates, and to report to the Council." It was further resolved, "That the Committee consist of Mr. Crookes, Dr. Miller, Dr. Odling, Mr. Wanklyn, and Dr. Williamson."

Upon the presentation of the Committee's report, at a meeting of the Council, held on November 7th, it was resolved, "That this report be approved, and that a copy of it be sent to each Fellow of the Society."

We beg to append the report in question, and have the honour to remain,

Your obedient servants,

W. Odling,
A. Vernon Harcourt,
Hon. Secretaries.

"Your Committee were appointed by a resolution, passed at a Meeting of Council, held on May 16th, 1867, in fulfilment of the intention which the Council announced to the Society in its anniversary report.

"As bearing upon the standard of qualification for admission to the Fellowship of the Chemical Society, your Committee, from replies they have received to a circular which they addressed to all the Fellows, and from conversations they have held with different Fellows whom they chanced to encounter, have ascertained the existence among the Fellows of the Society of two very distinct views as to its nature and purposes.

Many Fellows appear to regard the Society as being by rights an association of eminent scientific men; and they accordingly look upon the Fellowship of the Society as a distinction which should be conferred only upon those who have given evidence of marked chemical proficiency, as for example, by the production of some original memoir; so that the election of any one as a Fellow of the Society should stamp him at once as being a well-trained chemist and competent investigator.

"In favour of this view, it is urged that the initials F.C.S., appended to the name of any gentleman, seem to imply that his attainments have won for him a public recognition somewhat in the character of a degree; and that these initials ought to signify, in reality, that which they seem to imply, and which is indeed their proper signification.

"It is further urged that the Fellowship of the Chemical Society is essentially an honorary distinction, although from the ease with which it can be obtained, practically by any who choose, it is a distinction but little valued by the better sort. It is, however, eagerly sought after and obtained by men who are not perhaps altogether desirable—who certainly have no claim to the title of scientific chemists—and who, in some cases, do not even join the Society from any interest they take in chemical science, but solely with the view of parading a distinction to which their merits do not really entitle them.

"Moreover, from the circumstance that chemistry is pursued, not only as a science but also as a profession and trade, the right to append the initials F. C. S. possesses a sort of trade value, exceeding its cost, to mere trading or professional chemists; as suggesting that those who have the privilege of using these initials are better qualified men than their brethren who are not thus distinguished.

"From these causes, it is said, the Fellowship of the Chemical Society has gradually sunk in public estimation; and accordingly it is very desirable that something should now be done to restore, if possible, its original prestige.

"On the other hand, many Fellows are of opinion that the Society is merely an association of individuals, having joint but various interests in the progress of both pure and applied chemistry; that the object for which the Society exists is not to confer honour upon any individual whatever, but to promote the general advancement, distribution, and application of chemical knowledge; and that, as a general rule, men engaged in pursuits more or less dependent on or connected with chemistry, and taking a sufficient interest in chemistry to wish to join the Society seould, unless personally objectionable, have every facility afforded them for joining it.

"In favour of this view, the preamble to the charter is adduced, and especially the following paragraph; whereas certain of our subjects 'did establish and are now members of a society known by the name of the Chemical Society, for the general advancement of chemical science, as intimately connected with the prosperity of the manufac-

tures of the United Kingdom . . . , and for a more extended and economical application of the industrial resources and sanitary condition of the community," etc.

"It is further maintained that the Society, from its origin until the present time, has always been of a mixed rather than of an exclusively scientific character—that the present Fellows form quite as distinguished a body as have ever constituted the Society—and that many, at any rate, of the most distinguished individual Fellows do not feel themselves at all discredited by being associated as joint Fellows of the Society with men who are engaged or interested in chemical pursuits, but whose scientific or social position is inferior to their own.

"Moreover, of scientific as distinguished from purely professional societies, the Royal Society, it is urged, is the only one of which the Fellowship is conferred in recognition of eminent scientific merit—the special science societies being practically open to all students of and workers at their spective subjects, who may wish to be elected to their respective Fellowships. To limit the Chemical Society then to eminent scientific chemists would be tantamount to making it the chemical section of the Royal Society, instead of allowing it to have a distinct function and character of its own.

"It is further urged that the circumstance of chemistry being to some extent a profession, so far from indicating the propriety of making the Fellowship of the Chemical Society an honorary distinction, rather contra-indicates it. For, independently of the difficulty, or rather impossibility, of withholding or conferring the honour without doing much injustice to individuals, the Society, by professing to choose out the most worthy, would naturally be held responsible for its choice, and identified more or less with the acts of each and all of its Fellows.

"Your Committee having given these different views their best consideration, are not prepared to recommend any alteration in the bye-law relating to the election of Fellows, which would have the effect of confining the Fellowship of the Society to strictly scientific men.

"But they think it may be advisable, although they have failed to elicit evidence of the admission of any significant proportion of unsuitable persons into the Society, to make some modification in the present by-law, with a view to increase the security against the accidental election of undesirable candidates.

"They accordingly suggest that in future, or after a certain interval of time, the form of recommendation of a candidate, referred to in the first paragraph of the by-law in question, shall be required to be signed by five instead of by only three Fellows of the Society, of whom three at least instead of only one shall be required to sign from personal knowledge; and further, that in the second line of the printed form of recommendation, the words 'Qualification or Occupation' shall be substituted for the words 'Position, Profession, or Occupation.'

"At present your Committee are not disposed to advise any alteration in the second paragraph of the by-law, which requires three-fourths of the votes given to be in favour of the candidate, in order to effect his election. If, however, contrary to the anticipations of the Committee, any section of the Fellows should be found to make an improper use of this requirement, your committee would then recommend that one or other of two courses should be proposed by the Council and adopted by the Society; that is to say, that the by-law should be so altered as to render valid the election by a mere majority, or else that the by-law should be temporarily abrogated, and during its abrogation the election of Fellows be delegated by the Society at large to a Committee appointed for the purpose."

THE INSTITUTION OF CIVIL ENGINEERS.

The first meeting of the Session 1867-68 was occupied by the reading of a supplement to and the discussion upon the Paper "*Experiments on the Removal of Organic and Inorganic Substances in Water*," by Mr. Edward Byrne, M. Inst. C.E., which was read at the close of last Session. The author now gave an account of experiments he had since made on the well-known filtering materials, magnetic carbide, and silicated carbon; and, after recording the results in a tabular form, he proceeded to make a comparison between those substances and animal charcoal.

His experiments were to the effect, that the action of the magnetic carbide was exceedingly feeble as regarded the removal of organic and inorganic impurities, and that it did not possess the property of softening the water except to a very small extent; whereas this property was possessed in a high degree by the two other filtering materials. Silicated carbon, however, quickly lost this power, and, after a short time, it rendered the water positively harder than it was before filtration. Animal charcoal, in its softening property, was not only more powerful than the silicated carbon, but more permanent in its action; and so far as the experiments went, it continued to remove inorganic matter. After a short time, however, it commenced to give back a portion of the organic impurity which it had previously removed. The silicated carbon, too, was found, in an equally short time, to give back not only the organic, but also the inorganic, matter which it had previously taken up.

To decide whether the organic matter contained in the water, so far as the nitrogen was concerned, had undergone any oxidation by its passage through these substances, the amount of nitrogen in the original water, and in that passed through each filter, was determined by the process which Professor Wanklyn had recently made known. By this extremely delicate test it was found that, for equal quantities of organic impurity, the amount of albuminous matter in the original and in the filtered waters was precisely the same; which fact was considered a sufficiently clear proof that the organic matter contained in the water had undergone no change by its percolation through these filtering materials.

The author then expressed the opinion, that while filtration must ever be considered most valuable for the removal of matter in mechanical suspension, it was practically useless as a means of removing substances in solution. He argued that the deductions to be drawn from these experiments, though made on a small scale, would, by reason of the systematic manner in which they were conducted, be safely applicable to cases of far greater magnitude. He concluded by expressing a hope, that the result of these investigations would serve the purpose of pointing out the danger of depending too much on the system generally of filtration, as well as of exposing the inconsistency of bringing home foul water, to undergo a delusive method of purification; instead of adopting the proper and only satisfactory plan of procuring water which was itself naturally pure.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, November 12th, 1867.

Edward Schunck, Ph.D., F.R.S., &c., President, in the Chair.

Mr. John Barrow was elected an Ordinary Member of the Society.

Mr. Binney, F.R.S., F.G.S., said that in the Rev. J. G. Cumming's excellent "History of the Isle of Man" that author, at page 132, says, "the different layers of the Posidonian schist vary both in their lithological texture and organic contents. The finest and most compact laye

which is worked for ornamental purposes, is characterised by an abundance of Posidonia and the relicts of tree ferns, which we must necessarily regard with interest as indicating an approach, though still at a considerable distance, from the coal formation of Great Britain." As the discovery of fossil tree ferns in the mountain limestone would be of great interest, he had lately been over to Poolvash Bay, the locality named by Mr. Cumming, and spent a considerable time in searching the black limestones there for those fossils; but although he met with plants, the remains of vegetables common to the carboniferous formation, such as *Stigmaria ficoides*, *Calamites*, and other coal plants, he found nothing resembling tree ferns. The state in which the roots (*Stigmariæ*) were found in this limestone led him to believe that Mr. Cumming had mistaken them for tree ferns. The depressed areolæ in this fossil have the lower portion of the radicle attached to them so as to give the appearance of a scar not much unlike that of a tree fern, but he convinced himself that they were unquestionably *Stigmaria*. This portion of *Sigillaria* is often met with in the beds of limestone in the Yordale series of Professor Phillips, as well as much lower down in the carboniferous series in the limestone of West Calder, near Bathgate, Scotland, where it occurs in great abundance. He also stated that the lower coal seams of Scotland containing workable beds were of considerably earlier date than the Posidonian schists of the Isle of Man.

Dr. R. ANGUS SMITH, F.R.S., said that he had frequently visited some parts of the Continent, and had been a students of exhibitions such as included the useful arts. He was quite prepared to agree with those who saw a very great improvement in the touch of the workman, in the countries nearest to us, in the north of Europe especially. In France the advance made was very great, and so also in Germany; but in neither of these cases did he consider that the exhibition showed the true state of the arts among the people. A true exhibition would give the proportion of bad and of good manufactures. There was no attempt to do this except in cases where the objects were viewed rather as curiosities, as for example, when costumes and architecture were introduced. When a number of knife makers showed their manufactures, it was clear that they all showed their best, but they did not show how many made knives that would scarcely cut, and even if they had done so, it would not have been sufficient to exhibit the state of the arts among the people. It would not inform us how many of the population had no knives set down to them at dinner, and how many houses had not a fork of any kind. In one of the countries which had made greatest progress and showed beautiful work of all kinds at the Exhibition, he had been in an hotel where no fork whatever existed, and when he asked for a knife, the landlady handed him one from her pocket. Yet she and the landlord were very respectable looking people, and the house was clean. True, it was only in a village, but it was only a few miles from a considerable town. The people were not the poorest, but probably the richest in the village. He had not found any similar case in Great Britain. These were decent people of the working classes in want of what we may consider the ordinary tools requisite in modern civilisation only three years ago. He did not wish to speak of any manufacture for the study of which he may have had special opportunity, but, speaking generally, he did not think that the modern changes had penetrated all classes of the community so deeply in France and Germany as the Exhibition represented, whereas England had done more than it showed at the Paris Exhibition. This is quite independent of the question which is best, and relates only to the useful arts.

It is clear, however, that wonderful advances have been made, and who makes them? He considered that they were made by the upper classes of the manufacturers, and used by the upper and middle classes, but had not descended universally even to the middle classes. When the general descent takes place, the manufacturers will have a much larger home market than they have at present. It is for the interest of England that this advance among the people should take place, as in some instances it will prevent competition in foreign markets; but whatever the commercial result may be, there is one lesson which we may all learn. Within the last thirty or forty years, the violent attempts to teach the people here by schools, mechanics' institutes, and lectures given or promoted by benevolent persons attaching themselves to various societies, have wearied the souls of all who have co-operated or even looked on with interest. In Germany, without any commotion, calmly and pleasantly, the youths have been trained in schools and colleges without number, and so thoroughly that they are able to supply foremen and managers to their own manufacturing establishments, and to send a supply also to foreign countries, without diminishing the supply of that higher order of men of learning that have so long made Germany famous. In other words, whilst we have failed after the most violent efforts and much noise to teach our own, they have succeeded not only to teach their own citizens, but to assist in educating the rest of the world. In this matter of education, the governments have been able to mould the nation's mind, and to alter the habits of a leading portion of it in a very few years. A careful education would probably show its influence in less than ten years. True, many questions arise; and we may ask if education would not smooth down the peculiarities of the national character, and prevent it trusting to individual will and genius. Pedantic education might do this, but training is certainly as requisite in civil as in military affairs, and no one says that discipline diminishes the power of an army. It may be a question whether the uniform organisation of education in France is not calculated to produce too much equality in the minds of the nation, but it will certainly produce immense power in the aggregate. The numerous small states of Germany, each fostering its own schools and universities, seem best fitted to produce an intellectual activity. We see there, many universities, each developing its own peculiarities. They must make the nation more many-sided, and they have done so. At any rate, the present lesson seemed to be that the more intelligent part of a nation may be fashioned anew in a few years by its instructors as easily as a boy may be taught to be either a shoemaker or a tailor; cases of original bent excepted. We desire schools in this country, but cannot find them; there is no organisation for making them to the extent they are required. The genius of this nation, great as it really is, impatient of details, and looking vigorously to results, will never compete in a wild state with the disciplined army of thinkers and of manufacturers abroad. Those who do succeed here must train themselves, and to that training they owe their success, but it is hard work, and not to be expected of many. However, it is clear that an entirely new spirit may be made to animate society in the course of a single generation, and a nation may be born in our own day; also, as the result has been, so far as the useful arts are concerned, exactly that which the rulers desired, we must believe that governments or large combinations of men have the change in their power.

It was said that this progress in the arts did not necessarily go down to the whole of society. There may be several reasons for this: the upper classes may be far advanced and the lowervery poor, even when there is much good feeling. In some of the mining districts of Germany, sending out the most intelligent miners to distant parts for centuries, and teaching their own with great care in schools which have been imitated, but not surpassed, we find a population extremely poor. Nature has presented little to them. We cannot expect all farmers to be equally rich, when soils differ so much. In such cases, however, we can expect a careful superintendence and a thoughtful mode of husbanding resources, mitigating the evils of poverty, and producing content where otherwise abject misery would exist, and that we find.

The Exhibition shows how much may be done for the active minds of nations by a government fostering education, and the state of the same countries shows that intelligence, comfort, and wealth have been promoted also. Whilst the poorer parts alluded to, in Saxony for example, show that when from natural causes wealth has not been accumulated, education has produced intelligence to mitigate those evils which would otherwise have crushed the people. This education is owing to the activity of the governments. We learnt the lesson in this island once, and forgot it. We must be humble enough to learn it again from the world, instead of teaching it to them as we ought to have done.

The unassisted working classes in this country have raised themselves to an enjoyment of the products of civilisation not equalled probably anywhere in Europe, and their progress has been of longer duration; as we love our country we are still disposed to believe in its power of keeping in advance. But how could a regiment, however brave, advance with longbows against modern artillery?

We require education in the fundamental principles of physical science; the moral principles and teachings found in literature are not, when alone, sufficient either for the higher cultivation of every mind or the pursuit of the useful arts. This applies to the rich and not merely to the poor.

ACADEMY OF SCIENCES.

November 25, 1867.

(FROM OUR OWN CORRESPONDENT.)

Paralysis caused by Santonine—Safety in performing large Amputations—The "Just Susceptibility" of Marshal Vaillant.

M. Eugene Pelikan, director of the civil medical department of Russia, &c., presented a note on the local paralysis produced by saponine and analogous substances. He summed up the results of his experiments as follows: 1. Saponine and similar substances produce a local paralysis, followed by a rigidity of the muscles, and also paralysis of the nerves of sensation; 2. With regard to this local paralysing action, there exists an analogy between saponine and substances acting upon the pupil, such as atropine, physostigmine, &c.; 3. Saponine, now employed in medicine, is probably destined to perform another part than that at present attributed to it, and for this reason it should be submitted to new clinical experiments; 3. That saponine does not cause either contractions of the muscles or of other parts to which it is applied, and that it annuls completely the irritability of the muscles (even rendering them rigid) submitted to its action, provided that the animal is in its normal state of health and is in possession of all its functions.

Dr. Maisonneuve, surgeon of the Hotel Dieu, read a paper on the continuous method of aspiration and on the advantages for the healing of great amputations. In a recent work presented to the Academy he explained that:—The numerous and febrile accidents which render complex the greater number of wounds, and which constitute the principal danger of surgical operations, are always the result of poisoning. The liquids exuding from the surface of the wound become morbid in contact with the external air, and poisonous putrefaction at once ensued, and the author came to the conclusion that the liquid at the surface of the wound could be hindered from putrifying and that great surgical operations, such as amputations, &c., could thus always be performed with safety to the life of the patient. The process recommended by Dr. Maisonneuve consists in submitting the stump of the limb amputated to a continuous aspiration, which draws off the liquids secreted by the wound according as they are formed, and to transport them to a recipient before they have time to putrify. The following is the method employed: After having as usual stopped the flow of blood, by means of the ligature of the vessels, the wound is cleaned most carefully; it is washed with alcohol and dried with clean dry linen; the edges are gently united by means of bands of diachiglon plaster, but without hindering the flow of the liquids; a layer of lint is then laid on, saturated with antiseptic liquids such as tincture of arnica, aromatic wine, or any other analogous substance, and the extremity of the limb is bound round with cloth soaked with the same liquid. After this preliminary dressing the process of the aspiratory apparatus is brought to play. The apparatus is composed of: 1. A sort of burette of caoutchouc furnished with a tube of the same substance. 2. A flask of three or four litres capacity; 3. An air pump which exhausts by means of a flexible tube.

Dr. Guerin read a memoir on the same subject, viz., Pneumatic Occlusion of Wounds, and he claims priority for his process. His apparatus consists of a very stout glass receiver with three tubular openings, one at the top and two lateral. That at the top leads to a dynamometer of very simple construction, a graduated glass tube terminated by an india-rubber ball filled with mercury. If the pressure diminishes, or a vacuum takes place in the balloon, the india-rubber bag dilates, and the level of the mercury lowers in the tube, thus giving the variations of the pressure. The inventor is convinced that by his method the expenses of hospital dressings and the dangers of operations will be much diminished. He has shown us his apparatus, which we have much admired, and he informs us that, at the Hotel Dieu, Dr. Maisonneuve had obtained wonderful results with his apparatus, which, after all, is only a modification of that of Dr. Guerin, to whom belongs exclusively the idea of the application of pneumatic occlusion to wounds, amputations, &c. We were eye-witnesses to the efficacy of Dr. Guerin's valuable instrument.

The Academy of Sciences has lost, for the time being, one of its most learned and honourable members, Marshal Vaillant, whose bland and noble countenance was one of the principal ornaments of the meetings. A just susceptibility has kept him at a distance, for more than six months, from his companions, for whom he was always ready to render a service, and to whom he was much attached. A favourable occasion has presented itself of bringing him again to the vacant chair which he had deserted. He has been named member of the commission charged with presenting a list of candidates to fill the place of free academician, vacant by the death of M. Civiale.

F. Moigno.

NOTICES OF BOOKS.

Companion to the New Edition of the British Pharmacopœia 1867. By Peter Squire, F.L.S. London: John Churchill and Sons, New Burlington Street. 1867.

We are glad to find that Mr. Squire's Companion has reached a fifth edition. The reward is well deserved, and is accorded to few works of the kind; and this fact alone would suggest the void there would be in the literature of *Materia Medica* without it.

But a still more unprecedented fact is that this current edition has been reprinted within the short space of a fortnight, owing to the great demand. It was wise therefore, we think, to make no additions to the reprint, so as to avoid the formation of a new edition. However, if the sale of the work is sufficiently great, a new edition will, we hope, be prepared shortly, which will incorporate in it many new researches in Pharmacy, such as the use of carbolic acid externally in various solutions, the extended applications of the new remedies of the Pharmacopœia, and the detection of impurities in various

commercial specimens of drugs, for so many of which researches we are indebted to Mr. Daniel Hanbury, *e.g.*, Burgundy pitch and Storax. Mr. Squire will find his materials now increasing in a very rapid progression, and will yearly find the duty that he has undertaken a more difficult one. This perhaps may be sufficient to atone for some trifling matters which under other circumstances might serve for complaint.

Thus when a new and strikingly useful remedy is proposed, and the formula for the preparation of such is given, it is only fair to mention the authority introducing this, as a sort of guarantee.

A remedy proposed by Mr. A. may have its own value, but one proposed by Dr. B., whose name is a household word in the profession, may probably be thought more worthy of a trial.

In two succeeding paragraphs Mr. Squire gives a notice of urethral suppositories, or medicated bougies, followed by that of the medicated pledgets of cotton. The latter we are told were introduced by Dr. Greenhalgh, but who introduced the former? We should have thought that the name of Sir Henry Thompson, a court surgeon, would have been not only gracefully, but also authoritatively coupled with the mention of medicated bougies.

Again, under the head of Staphisagria we find only this, "The oil of the seeds, 1 to 7 of lard, has been successfully used by Mr. Balmanno Squire in *Prurigo senilis*." By the omission of the fact that an Unguentum Staphisagriæ (made from the seeds) has been prepared in most of the hospitals of London for many years, it is implied that Mr. Balmanno Squire was the first to make known the vermicide properties of Staphisagria.

When in a work of authority, names of originators are given, it is impossible to exercise too much delicacy and tact.

All the chemical formulæ are given as in the Pharmacopœia of 1867, with the addition of the equivalents; we get as a result the following information: "Diluted phosphoric acid, $3HO,PO_5$, or H_3PO_4, eqv. 98, dissolved in water . . . 6 fluid drachms contain half an equivalent PO_5, or a quarter of an equivalent P_2O_5." The confusion here results from following too closely "official" authority.

The chief value of the work, viewed as a whole, lies in the amount of practical observation shown by its author, and the list of antidotes and incompatibles, always a very strong feature, has been in this edition strengthened still further. This information, so often neglected in text-books of *Materia Medica*, is really indispensable, and Mr. Squire's book is the authority in this respect. The "Companion" may be fairly called the parent of the Pharmacopœia for the United Kingdom, but the honour of having for a younger offspring, a universal Pharmacopœia, or Codex, is we believe quite unattainable. The present edition, or perhaps the next, with a chemistry adapted to Continental views, we think deserves that honour as much as any work does. If any of our readers are about to purchase the British Pharmacopœia, we offer them the advice of *Punch* to those intending to marry, —"don't," buy "Squire's Companion" instead.

CORRESPONDENCE.

ORGANIC MATTER IN WATER.

To the Editor of the Chemical News.

SIR,—Since the publication of Messrs. Wanklyn, Chapman, and Smith's paper, which has furnished a process, at the same time both qualitative and quantitative, for the estimation of organic matter existent in potable and other waters, the idea has suggested itself to me that the results obtained representing the amount of ammonia in millegrammes per litre, present as such, or in the form of albumenoïd nitrogen, may perhaps be regarded degrees, or parts of a degree, referable to some arbitrary standard.

For such a standard, we may take for instance ·1 mlgrm. of ammonia per litre, and call that quantity 1° of nitrogenous matter. The amount I have chosen, viz. ·1 mlgrm. is perhaps not the one best adapted to the purpose; it is a quantity however, often found in the analysis of waters, and will serve for explanation.

I will give the results of three analyses lately made, and then apply the system I propose.

The specimens examined I have numbered 1, 2, and 3. 1000 c.c. was taken for No. 1, and half that quantity for Nos. 2 and 3. The examination was conducted in the manner described by the authors of the paper above referred to.

Water No. 1 is a specimen of that supplied by the Liverpool Corporation to the town in which I am staying. No. 2 was taken from a brook contaminated to some extent with sewage; No. 3 was from a stream receiving much sewage and refuse from bleach and other works.

I have, for the sake of comparison, examined waters from three totally different sources, waters in which the ratio of organic impurity was presumed to be progressive

No. I. 1,000 c.c. By distillation with Na_2CO_3		No. II. 500 c.c. By distillation with Na_2CO_3	No. III. 500 c.c.. By distillation with Na_2CO_3
1st 100 c.c.	Mlgrm.	Mlgrm.	Mlgrm
2nd . .	·0	·07	·09
By alkaline permanganate	·15	By alkaline permanganate ·47	By alkaline permanganate ·75
	·15	·54	·84

In order to compare the above results it is necessary to double the amounts of ammonia found in Nos. 2 and 3, and we have—

No. 1	·15
No. 2	1·08
No. 3	1·68

Translating these figures into degrees, and taking ·1 mlgm. of NH_3 per litre as the representative of a water of 1° of "organic nitrogen," we have for—

No. 1 a water of	1°.5
No. 2 ,,	10·8
No. 3 ,,	16·8

It will be seen that I have not made any distinction between the degrees corresponding to the ammonia originally present as such, or due to the decomposition of urea, and those which represent the amount afterwards evolved on the addition of alkaline permanganate, but some distinction will probably be necessary.

I may remark, in conclusion that the result of the analysis of water No. 1 confirms Professor Wanklyn's statement in the *Laboratory* (No. 26, page 442), with reference to the stability of albuminoïd matters in the presence of a boiling solution of sodic carbonate of the strength used by himself and colleagues in their process.

—I am, &c.,

PHILIP HOLLAND.

Chorley, Lancashire.

SALT AS AN ADULTERANT IN THE DYEING TRADE.

To the Editor of the Chemical News.

SIR,—Amongst the substances fraudulently added to chemicals and drysalteries, both organic and inorganic, common salt holds a prominent place. When thus employed it not merely dilutes or lets down the article to which it is added, but often exerts a most injurious positive action. Thus when used to "spring," as it is called, extracts of dyewoods, it very much injures their quality. It is well known that to dye an even, fast, and brilliant shade the

colouring matter must be held in a state of perfect solution; or, if insoluble in the finest possible suspension, so that it may be slowly and gradually delivered to the fibre. Now the presence of salt impairs the balance between the solvent and the colour, and causes the latter to be rapidly and irregularly deposited on the surface of the goods in a dull state, capable of easy removal. In some cases the affinity of the fibre for the colour seems masked, so that the latter, instead of "taking on," falls as a sediment to the bottom of the dye-pan. At other times a colour or mordant previously put on is impoverished by the salt thus present. Thus to take a very common case—suppose a coburg or union damask has to be dyed green. The worsted having been dyed as usual, and the warp done a Prussian blue, the piece is passed through extract quercitron. If this has been adulterated with salt, the piece when apparently dyed will be found, after having been rinsed and dried, to have a green weft and a pale blue warp, the Prussian blue deposited on the cotton having been impoverished by the salt.

Ground turmeric is another article often mixed with salt, which imparts to it a brighter appearance in the state of powder. The action of the salt here is very similar to what has been above described. The mordants are, as the dyers term it, "naiged away" from the warps of the salt. Drysalters, when the salt in their turmerics is detected, have been known to state in extenuation that the article had been damaged by sea water, although men in their employment own that they are told to mix a certain proportion of salt with the root during grinding.—I am, &c.,

W.

MISCELLANEOUS.

Encouragement of Chemistry in France.—Dr. Quesneville writes in *Le Moniteur Scientifique*: "We have just heard two pieces of bad news. The first, which is irremedial, is the death of Millon, that distinguished chemist, whose career was cut short and health impaired by being sent to pass the best years of his life in Algeria, because his liberal opinions were too advanced to permit his remaining in Paris; The second is the arrest of our distinguished colleague M. A. Naquet, *Professeur Agrégé à la Faculté de Medicine*, which was doubtless owing to the same cause."

The Frescoes in Westminster Palace.—Mr. Ward has been recently engaged in the reparation of his pictures in fresco and water-glass, which fill panels in the Commons Corridor (these had, in more than one case, been affected by unknown and variously effective causes), and has succeeded to his satisfaction, so far as the experiment permitted. After cleaning the works with bread, they were coated with gelatine size, and the artist repaired the affected part with pure water-colour, which embodied with the size and formed distemper. The general appearance of the picture being thus restored, a coating of a new composition, consisting of benzole and paraffin, was applied to some of the parts which required additional fixing, and had the effect of deepening the colours and enriching the tones, as varnish upon oil-painting, without the shining surface. Except in one or two cases, this latter application was not made to the heads. This new mixture has been extensively employed on the pictures by Dyce in the Queen's Robing Room, which had suffered from the scaling off of portions of their surfaces, and, as we have witnessed, with remarkably good effect, that will be, we trust, permanent. The composition by Dyce, called "Courtesy," has been entirely covered thus. The large picture called "Hospitality" has not yet been so treated, and truly looks so brilliant and well in tone, that it will be superfluous to touch it. These pictures are pure frescoes; but the application may be made to distemper or size-painted works, as with those of Mr. Ward. The fluid is warmed, and used at a temperature of about 70°, the surrounding atmosphere being heated to that degree. Mr. Wright, chemist of Kensington, devised, and, in conjunction with Mr. Cope, R.A., perfected the composition in question, which has been employed, with the sanction of Dr. Percy on the part of the Government, upon his own pictures at Westminster whenever they required it.—*Athenæum.*

Magnetic Carbide Filters.—In the *British Medical Journal* of last week the following paragraph appeared; "Our excellent contemporary, the Chemical News, seems to doubt, in their remarks upon this Report on the Purification of the Hooghly Water for the Supply of Calcutta, the value of the method of filtration by magnetic carbide. We can assure the Chemical News that experience and experimental investigation fully bear out the statements of Mr. Spencer. That 'so little has been heard of this process during the seven years in which the author says he has had practical experience with it,' perhaps Mr. Spencer or his friends can best explain. And it is, indeed, true that, considering its importance, it is little known; for 'if,' as our contemporary remarks, 'the purifying material possess the virtues accorded to it by the discoverer, it is especially our duty to protest against anything less than the universal application of the process in this country.' We regret that the purport of our remarks has been misunderstood, but at the same time we find no reason to qualify the opinions we expressed. Our objections took ground less against Mr. Spencer's *process*, than his *theories* explaining the action of magnetic carbide. Our talented contemporary is silent upon these, and would possibly hesitate, for instance, before allowing, with Mr. Spencer, that magnetic oxide of iron impregnated with carbon, in virtue of its magnetic nature, attracts into its pores the oxygen from atmospheric air, leaving the nitrogen behind. If Mr. Spencer can prove this it would be highly interesting, but at present evidence tends to an opposite conclusion, in fact the experiments of Faraday prove the contrary. Granting, for the sake of argument, that oxygen is attracted into the pores of magnetic carbide, what proof, or even probability is there of it being thereby converted into ozone? The extracts inserted in the article upon the water supply of Calcutta (Chem. News, p. 231) must we think, have shown our readers how much rested upon Mr. Spencer's *ipse dixit*, and how little upon experiment. It is not too much to say that if experiment bore out these statements they would possess extraordinary interest for the scientific world. With regard to the process itself we do not deny that magnetic carbide exerts a purifying action upon water, possibly greater than carbon. But as to its differing from carbon in the action not gradually declining after immersion in water, we can only say that experiments such as carry conviction to the minds of scientists are wanting, whilst the assertion is opposed to the existing opinions upon the subject.

CONTEMPORARY SCIENTIFIC PRESS.

(Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the "Chemical News.")

Journal fur Praktische Chemie.

No. 14.

C. F. Schonbein, "On the Presence of Ozone in the Atmosphere." Fritzsche, "On the Solid Hydrocarbons of Coal Tar." F. Beilstein and U. Kreusler, "On Para-Nitrotoluylic Acid and its Derivatives." C. F. Barfoed, "On the Isomerism of the Stannic Acids."

No. 15.

E. Mulder, "On Trisulphocarbonic Acid Acetonium." F. Goppelsroder, "On a Fluorescent Substance obtained from Cuba Wood." J. C. Igelstrom, "On the Analysis of some Minerals from Wermland, in Sweden."

Bulletin de la Societe d'Encouragement.
June, 1867.

H. Bouillet, "On the Production of Busts and Statues by the Electrotype Process.—On the Electro-deposition of Gold of various Colours." Stoss, "On the Use of Oxide of Chromium for Polishing Metals." Balard, "On E. Carré's Improved Machine for the Manufacture of Ice by the Absorption of Aqueous Vapour by Sulphuric Acid in a Vacuum." Dumas, "On the same Subject." Thenard, "On the Preservation of Milk by the Application of Cold, *à propos* of the same Subject." Peligot, "On the Flexibility of Glass." De Luynes, "On the Colouring Matters of Orcine, and on a Product derived therefrom analogous to Carthaminic Acid." Isambert, "On two improved Magnesium Lamps." Dumas, "On a Specimen of Anthracite or Black Diamond of remarkable hardness." Bouis, "On De Milly's Improvements in the Manufacture of Fatty Acids." H. Monier, "Improved Crystal Gas Burners." J. Agnellet, "On the Foundation of a Prize for an improved constant Battery." Dumas, "On the Manufacture of Tartaric Acid."

L'Invention.
August, 1867.

M. Milan, "A Process for extracting Silver from Lead." Rave, "On a new Aniline Black for the Manufacture of Printing Ink." Schlumberger, "On the Preparation and Use of a new Green Colouring Matter extracted from Toluidine. Piedaul, "On the Use of a Solution of Fatty Matters in a Hydrocarbon or in Bisulphide of Carbon for preserving and softening Leather" P. Javal, "On the Preparation and Use of certain Fatty Bodies." Mallet, "On the Production of Oxygen and Chlorine Gas. either together or separately, from Sub-chloride of Copper." Schlumberger, "On the Preparation of some Blue and Violet Colouring Matters from Rosotoluidine."

Dingler's *Polytechnishes Journal.*
August, 1867.

A. Ott, "On Lugo's Apparatus for Distilling Petroleum." H. W. Ilgen, "On the Use of Refuse Grape Skins for manufacturing Gas and Lamp Black." "On the Manufacture of Plastic Charcoal for Filters."

Kunst und Gewerbeblatt.
June, 1867.

R. Wagner, "Report on the Chemical Products at the Paris Exhibition." E. Dieterich, "On the Preparation of Indigo Carmine." R. Wagner, "On the Detection of Paraffin in Samples of Wax by a Comparison of their relative Specific Gravities."

Journal des Fabricants de Papier.
July 15, 1867.

E. Bourdilliat, "On Testing the Chemical Products used in Paper-making. Continuation: Sulphate of Iron."

Revue Universelle des Mines.
March—June, 1867.

L. Perard, "On the Conservation of Force." P. Kupffer-schlaeger, "On some Modificatious of Marguerite's Process for the Volumetric Es imation of Iron." Grundman, "On the Decomposition of Coals when exposed to the Air."

PATENTS.

Communicated by Mr. Vaughan, F.C.S., Patent Agent. 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3127. E. C. Prentice, Stowmarket, Suffolk, "Improvements in the treatment of gun-cotton and charges or cartridges made therefrom, as also in the processes employed in their manufacture."

3132. I. Baggs, High Holborn, Middlesex, "Improvements in preparing and oxidising certain substances capable of producing chlorine."—Petitions recorded November 6, 1867.

3168. E. B. Wilson, Bolton, Lancashire, "Improvements in furnaces."—November 9, 1867.

3194. J. C. Bayley, and D. Campbell, John Street, Adelphi, "Improvements in fire-lighters and fire revivers."

3198. W. H. Crispin, Marsh Gate Lane, Stratford, Essex, "Improvements in the manufacture of artificial fuel."—November 12 1867.

NOTICES TO PROCEED.

1924. G. A. F. Fowlke, St. James' Street, Westminster, "Improvements in compositions for preventing the fouling of the bottoms of ships, floating docks, and other similar structures, and in the mode or means of applying the said compositions."—Petition recorded July 2, 1867.

2611. C. Holste, Henrietta Street, Covent Garden, Middlesex, "Improvements in blast furnaces."—A communication from F. Lurmann, Oeside, near Osnabruck, Prussia.—September 17, 1867.

3332. J. Young, Aspull, Lancashire, "Improvements in the application of cannel coal 'slack' to the manufacture of gas and coke."—October 28, 1867.

2006. G. Gabillon, Rue Jaquelet, Paris, "A process to prepare and preserve paper and tissues with a solution of perchloride of iron, intended for stopping the bleeding of wounds."—Petition recorded July 9, 1867.

2046. J. Hargreaves, Appleton-within-Widnes, Lancashire, "Improvements in the manufacture of steel and soft iron from cast iron."—July 12, 1867.

2973. W. Brookes, Chancery Lane, "An improved method of treating hides in the process of tanning, and for apparatus employed therein."—A communication from M. M. J. Hallenstein and A. Cleghorn, Footscray, Victoria.—October 22, 1867.

NOTES AND QUERIES.

Bleaching Palm Oil.—Referring to No. 414 of your valuable journal, I beg to acknowledge with grateful thanks to Mr. C. R. A. Wright his full and clear description of the method of bleaching palm oil by chromic acid. I have been greatly more successful since applying the proportion of the bleaching agents which he prescribes. I have also discovered the desirability of keeping the materials well up together while the bleaching is going on; and as he suggests a method of agitating superior to the employment of paddles, viz., "to blow air through the mass," I wish Mr. Wright to be good enough to inform me the description of apparatus necessary for this purpose, and also if the temperature of the air must be elevated to correspond with that the oil.—George Johnson.

Spontaneous Ignition of Charcoal.—I cannot agree with "Scrutator" that this phenomenon is certainly new, as I have met with several instances of it during the preparation of the "Granular Charcoal," recently noticed in your columns; lamp-black, after having been carefully washed and afterwards dried again, is very liable to ignite spontaneously, and on this very account is less used in pyrotechny than formerly. I have lately inspected some enormous stills used for the generation of sulphurous acid; the charcoal employed, if taken out for any purpose, is almost certain to undergo spontaneous combustion, sooner or later, unless quickly and carefully excluded from the air.—Wentworth L. Scott.

Spontaneous Ignition, or Combustion.—I beg to remind Mr Holmes that a great many porous substances, *e.g.* finely divided metals, so readily absorb oxygen from air as to become visibly incandescent in daylight; not only powdered wood charcoal, but that article in bulk, equally so animal charcoal, and pitcoal, are not unfrequently known to have got ignited, the cause being due to the rapid absorption of oxygen from the air aided by the bad conducting power for heat these substances are endowed with. To the same category belong the phenomena of the spontaneous ignition of hay, straw, flax, and saw-dust in large heaps, also, and this is a frequent cause of fires, the extreme danger of cotton or linen rags, tow, and even some kinds of paper saturated with oil and grease. A few years ago a remarkable instance of spontaneous ignition took place in ships anchored in the roads of Batavia. On board these vessels among the cargo was a quantity of Turkey-red dyed cotton which, as is well known, is obtained by the use of oil as mordant. It was clearly made out by careful experiments made by a scientific committee appointed to inquire into the cause of these fires, which were at first taken to be due to malice, that actually the spontaneous ignition of the Turkey-red dyed cotton was the true cause of the fire. The spontaneous ignition of charcoal has often been fatal to gunpowder works, while equally, the spontaneous ignition of animal charcoal has caused fires in sugar refineries.—Dr. A. A.

MEETINGS FOR THE WEEK.

Saturday, November 30.
Royal Society—Anniversary Meeting, 4 p.m.
Monday, December 2.
Royal Institution—General Monthly Meeting, 2 p.m.; Medical, 8 p.m.
Wednesday, December 4.
Geological Society, 8 p.m. "On the Graptolites of the Skiddaw Series." By Dr. H. A. Nicholson, F.G.S. "On the Fossil Corals of the West Indies."—Part IV. By Dr. P. Martin Duncan, Sec. G.S.
Pharmaceutical Society, 8 p.m.
Society of Arts, 8 p.m.
Thursday, December 5.
Royal Society, 8½ p.m.
Chemical Society, 8 p.m.—"On Artificial Formation of Coumaric Acid." By Mr. H. W. Perkin.
Friday, December 6.
Geologists' Association.

TO CORRESPONDENTS.

NOTICE.—The Printing and Publishing Offices of the Chemical News *are Removed from Wine Office Court, Fleet Street, to*

BOY COURT, LUDGATE HILL, E.C.

where all Communications are requested to be addressed.

H. Hallet.—The largest rough diamond on record was the "Great Mogul;" originally it weighed more than 6 ounces, but was reduced by cutting to two ounces. It is now lost.

Lux.—Manufactured on the large scale, oxygen would not be dear. It could be made for much less than 20s. per 1000 feet. The great objection to its introduction would be the necessity of having two sets of mains in all the thoroughfares.

Querist.—*Must* and *musk* are very different things: the former is the technical name given to the unfermented juice of the grape, the latter is an animal perfume. From the context it is evident that your correspondent has made a clerical error and refers to the former, not to musk.

THE CHEMICAL NEWS.

Vol. XVI., No. 418.

ON MONO-CARBON COMPOUNDS.*

By Dr. ODLING, F.R.S.

The principal compounds of carbon with hydrogen, oxygen, and nitrogen, which contain only one atom of carbon in their respective molecules, are the following: The existence of methylen H_2C, is very doubtful.

H_4C Marsh-gas or methene.
H_4CO Wood spirit or methyl alcohol

H_2CO Formic Aldehyd.
H_2CO_2 Formic Acid. CO Carbonous oxide.
H_2CO_3 Carbonic Acid. CO_2 Carbanhydride.

HCN Prussic or hydrocyanic acid.
HCNO Cyanic acid.

Formic acid furnishes only one class of salts, which are consequently monobasic, as exemplified by sodium formiate $NaHCO_2$, for instance. Carbonic acid furnishes two classes of salts, acid and entire, or mono- and dibasic, as exemplified by the two sodium carbonates, $NaHCO_3$ and Na_2CO_3, for instance. Carbonous oxide and carbanhydride gases may be regarded as dehydrated forms of the formic and carbonic acids respectively. Carbonic acid, indeed, H_2CO_3, is not known as an isolated compound, but only in the state of aqueous or dissolved anhydride.

In addition to the above formulated mono-carbon compounds, various derivatives of them exist, in which the constituent oxygen of certain of them is represented by sulphur, and the constituent hydrogen by chlorine or a congener, as in chloroform Cl_3HC, methyl mercaptan H_4CS, phosgene Cl_2CO, sulphocyanic acid HCNS, &c.

All the above normal compounds are susceptible of mutual metamorphosis, especially through the intervention of their chloro- and sulpho- derivatives, but the two simple oxides are alone directly procurable from elementary carbon. The principal metamorphic relations of the several compounds are as follows.

α. Methene, H_4C, is procurable from methyl alcohol H_4CO, indirectly, through the intervention of various methyl-compounds, such as methyl-iodide, mercury methide, &c., usually formed from the alcohol. The hydrocarbon and alcohol are more especially associated by means of methyl-chloride, which is both producible from and transformable into either one of them. Prepared from methyl-alcohol, for instance, it furnishes marsh-gas by the action of nascent hydrogen, thus:

$$ClH_3C + H_2 = H_4C + HCl$$

Methene is further procurable from formic acid H_2CO_2, by its transmission over ignited baryta, which serves to absorb the resultant carbanhydride:

$$4H_2CO_2 = 2H_2O + 3CO_2 + H_4C$$

Also, from the sulpho-derivative of carbanhydride, namely disulphide of carbon CS_2, by its reaction, conjointly with sulphuretted hydrogen, upon ignited metallic copper:

$$CS_2 + 2H_2S + Cu_8 = H_4C + 4Cu_2S$$

β. Methyl-alcohol H_4CO, is procurable from marsh gas H_4C, indirectly, by decomposing with potash its derivative methyl-chloride, a compound obtainable from marsh-gas, as already mentioned, by its gradual reaction with chlorine:

$$ClH_3C + KHO = H_4CO + KCl.$$

γ. Formic aldehyde H_2CO, a compound of very recent discovery, is obtainable by effecting the ærial oxidation of methyl alcohol vapour, by means of a coil of ignited platinum wire:

$$H_4CO + O = H_2CO + H_2O$$

δ. Formic acid, H_2CO_2, is procurable from marsh-gas H_4C, by decomposition of its derivative chloroform with potash:

$$Cl_3HC + 4KHO = 3KCl + KHCO_2 + 2H_2O$$

Also from methyl-alcohol H_4CO, by its reaction with heated soda-lime; and, with intermediate production of formic-aldehyd, by various oxidations of the alcohol, including its exposure to air under the influence of platinum black:

$$H_4CO + HNaO = NaHCO_2 + 2H_2$$

$$H_4CO + O_2 = H_2CO_2 + H_2O$$

Also from carbonous oxide CO, by its combination with heated caustic potash, to produce potassium formiate:

$$CO + KHO = KHCO_2$$

Also from carbonic acid H_2CO_3, by its reduction with metallic sodium, to produce sodium formiate:

$$H_2CO_3 + Na_2 = NaHCO_2 + NaHO$$

Carbonous oxide CO, is producible by the dehydration of formic acid H_2CO_2, with oil of vitriol, for instance; and by the deoxidation of carbanhydride CO_2, with ignited zinc, iron, carbon, &c.

ε. Carbonic acid H_2CO_3, is procurable from marsh-gas H_4C, methyl-alcohol H_4CO, and formic acid H_2CO_2, by various oxidations, as with moist chlorine for instance:

$$H_4CO + 3Cl_2 + 2H_2O = H_2CO_3 + 6HCl$$

Also from carbanhydride CO_2, by its solution in water, or its fixation by caustic alkali, to form a mono- or dibasic carbonate:

$$CO_2 + KHO = KHCO_3$$

$$CO_2 + 2KHO = K_2CO_3 + H_2O$$

Also from carbonous oxide CO, indirectly, through the intervention of phosgene, by decomposition of this compound with water or alkali:

$$Cl_2CO + 2K_2O = K_2CO_3 + 2KCl$$

Carbanhydride CO_2, is producible by the mere desiccation of carbonic acid H_2CO_3; and by the direct oxidation of carbonous oxide CO, as with air and spongy platinum for instance, or by different metallic oxides at a red-heat.

The formic and carbonic acids, with their anhydrates, have corresponding relations of metamorphisis to hydrocyanic acid and cyanic acid respectively.

Hydrocyanic acid HCN, when heated with oil of vitriol, absorbs one atom of water, with production of carbonous oxide and ammonia; and, when heated with potash, absorbs two atoms of water, with production of formic acid and ammonia:

$$HCN + H_2O = CO + H_3N$$

$$HCN + 2H_2O = H_2CO_2 + H_3N$$

Under similar treatment, cyanic acid HCNO, absorbs one and two atoms of water, with production of ammonia, and of carbanhydride and carbonic acid respectively:

$$HCNO + H_2O = CO_2 + H_3N$$

$$HCNO + 2H_2O = H_2CO_3 + H_3N$$

The ammonia, formed in the oil of vitriol reactions, appears of course as sulphate of ammonia, and the formic and carbonic acids, produced in the potash reactions, appear as potassium salts.

Independently of their origin from one another, and from cyanic compounds, as above described, the leading members of the methyl-formic families are obtainable from the following principal sources.

Methene occurs naturally as fire-damp, marsh-gas, &c., and forms an important constituent of ordinary coal-gas. It is usually made from acetic acid, the

* Dr. Odling has kindly permitted us to publish occasional Chapters from Part II. of his "Manual of Chemistry," which we are glad to be able to announce is now in the press.—Ed. C.N.

vapour of which undergoes decomposition, at a red heat, into equal volumes of methene and carbanhydride :

$$H_4C_2O_2 = H_4C + CO_2$$

Methyl alcohol, or hydrate, which forms the chief constituent of commercial pyroligneous spirit or wood-naphtha, is also obtainable from the methyl salicate occurring in gaultheria oil, from the methyl acetate found together with the hydrate in crude wood-naphtha, and from the methyl-chloride or iodide produced by the action of hydrochloric or hydro-iodic acid upon narcotine.

Formic acid exists naturally in the juice of red ants, &c. It can be procured by heating starch and similar organic substances with different oxidising mixtures; but is usually made by the decomposition of oxalic acid, a compound also resorted to as a source of carbonous oxide :

$$H_2C_2O_4 = H_2CO_2 + CO_2 = H_2O + CO + CO_2$$

Carbonic acid or anhydride is readily procurable from its different salts, whether found native, or produced artificially by the combustion of organic matter, coal, &c., in actual or virtual presence of bases. It is also a very frequent product of the oxidation and decomposition of organic compounds. Many organic acids, for instance, as already exemplified by acetic acid, undergo, when heated either alone or with caustic alkali, a decomposition into carbanhydride and some other compound. In this way salicic acid, for instance, yields carbanhydride and phenol :

$$H_6C_7O_3 = H_6C_6O + CO_2$$

The primary compounds of carbon may be conveniently considered as forming three distinct groups, namely, the methylic, typified by marsh-gas H_4C; the formic, typified by formic aldehyd H_2CO'', or marsh-gas, in which two atoms of hydrogen are replaced by one atom of diad oxygen; and the cyanic typified by prussic acid HCN''', or marsh-gas in which three atoms of hydrogen are replaced by one atom of triad nitrogen. The origin and relationship of the various cyanic compounds are discussed after the description of the individual methylic and formic compounds.

METHYLIC COMPOUNDS.

The relationship of methyl-alcohol, to methyl-chloride and methylamine respectively, corresponds exactly with that of water to hydrochloric acid and ammonia; and the three bodies may be regarded as derivatives of hydrochloric acid, water, and ammonia, by substitution of an atom of methyl for an atom of hydrogen :

H Cl	$(H_3C)Cl$	or	$(Cl)H_3C$	$(Cl)H$
H_2O	$H(H_3C)O$	,,	$(HO)H_3C$	$(HO)H$
H_3N	$H_2(H_3C)N$	,,	$(H_2N)H_3C$	$(H_2N)H$

By a further substitution of methyl for the hydrogen of water, there is produced methyl-ether, as above referred to; while, by its further substitution in ammonia, there are produced di- and tri-methylamine.

H Cl	$(H_3C)Cl$		
H_2O	$H(H_3C)O$	$(H_3C)_2O$	,,
H_3N	$H_2(H_3C)N$	$H(H_3C)_2N$	$(H_3C)_3N$

By a similar substitution of methyl for the hydrogen of methyl itself, as existing in marsh-gas and methyl-alcohol, for instance, there are produced the homologues of marsh-gas and methyl alcohol, or ethene and common alcohol respectively :—

H_4C	$H_3(H_3C)C$	$=$ H_6C_2	Ethene
H_4CO	$H_3(H_3C)CO$	$=$ H_6C_2O	Alcohol

And just as marsh-gas and methyl-alcohol are regarded as the hydride and hydrate of methyl, so may ethene and ethyl-alcohol be regarded as the hydride and hydrate of ethyl, and so do they form an ether or oxide corresponding to methyl ether, and three successive amides or nitrides corresponding to the three methyl-amines, &c.

$H(H_3C)$	$H(H_5C_2)$		
$H(H_3C)O$	$H(H_5C_2)O$	$(H_5C_2)_2O$	
$H_2(H_3C)N$	$H_2(H_5C_2)N$	$H(H_5C_2)_2N$	$(H_5C_2)_3N$

Moreover, various mixed or intermediate compounds are also known, such for instance as methyl-ethyl ether $(H_3C)(H_5C_2)O$, methyl-diethylamine $(H_3C)(H_5C_2)_2N$, &c. Thus the radicals methyl and ethyl, which, for brevity's sake, are often represented by the symbols "ME" and "ET," have the similar property of replacing hydrogen in a great variety of bodies, to form methyl and ethyl derivatives, corresponding closely to one another in constitution, formation, decomposition, and general behaviour; so that to almost every methyl compound there exists a corresponding ethyl compound; and indeed, from various causes, the ethyl series of compounds has been altogether better studied, and is more complete, than even the methyl series itself. In addition, however, to analogues of the different methyl compounds, the ethyl series, by reason of the greater complexity of its primary hydrocarbon, includes various compounds which have not, and cannot have, true methyl analogues.

By a further substitution of methyl in methyl-methyl or ethene, $H_3C.H_3C$ or H_6C_2, there is produced a new hydrocarbon propene $H_3C.H_2C.H_3C$ or H_8C_3, which may also be represented as propyl-hydride $H(H_7C_3)$, and of which propyl alcohol, H_8C_3O or $H(H_7C_3)O$ is the corresponding hydrate; and so on indefinitely. The earlier terms of this homologous series of hydrocarbons and alcohols, and of the acids resulting from the oxidation of the alcohols, are given in the following table :

Hydrocarbon.		*Alcohol.*		*Acid.*	
H_2	Hydrogen	H_2O	Water		
H_4C	Marsh-gas	H_3CO	Methyl	H_2CO_2	Formic
H_6C_2	Ethene	H_6C_2O	Ethyl	$H_4C_2O_2$	Acetic
H_8C_3	Propene	H_8C_3O	Propyl	$H_6C_3O_2$	Propionic
$H_{10}C_4$	Butene	$H_{10}C_4O$	Butyl	$H_8C_4O_2$	Butyric
$H_{12}C_5$	Eupione	$H_{12}C_5O$	Amyl	$H_{10}C_5O_2$	Valeric
$H_{14}C_6$	Caprene	$H_{14}C_6O$	Capryl	$H_{12}C_6O_2$	Caproic

Methene has some similarity, and at the same time considerable dissimilarity, to another hydrocarbon known as phenene, or hydride of phenyl H_6C_6; and just as ethene is produced by the replacement of hydrogen by methyl in methene, so is benzoene or toluol produced by the same replacement of methyl for hydrogen in phenene. The resulting methyl-methene or ethene, and methyl-phenene or benzoene, correspond closely with one another, and give rise to strictly analogous compounds and series, thus :—

Hydrocarbon.		*Alcohol.*		*Acid.*	
H_6C_2	Ethene	H_6C_2O	Ethyl	$H_4C_2O_2$	Acetic
H_8C_7	Benzoene	H_8C_7O	Benzyl	$H_6C_7O_2$	Benzoic
$H_{10}C_8$	Xylene	$H_{10}C_8O$	Xylyl	$H_8C_8O_2$	Toluic
&c.		&c.		&c.	

METHYL-HALIDES, ETC.

As previously mentioned, methyl chloride ClH_3C, is procurable from marsh-gas H_4C, by direct substitution of chlorine for hydrogen, and from methyl alcohol, H_4CO or $(HO)H_3C$, by substitution of chlorine for hydroxyl. It also occurs as a product of the decomposition by heat of the hydrochloride of kakodylic acid $H(H_3C)_2AsO_2.HCl$, and of the reaction of hydrochloric acid with narcotine. It is decomposible by potash, with reproduction of methyl-alcohol (Berthelot) :

$$ClH_3C + KHO = KCl + H_4CO$$

By the further action of chlorine upon methyl-chloride, there are produced, in succession, the higher derivatives Cl_2H_2C, Cl_3HC, and Cl_4C; but the decomposition of these compounds by caustic potash leads to the production, not of methylic, but of formic compounds, thus :

$$Cl_2H_2C + K_2O = 2KCl + H_2CO$$
$$Cl_3HC + 2K_2O = 3KCl + KHCO_2$$
$$Cl_4C + 3K_2O = 4KCl + K_2CO_3$$

The first of these reactions has not been established, owing probably to its incomplete examination. By treatment with nascent hydrogen, perchloride of carbon Cl_4C, is successively reconverted into chloroform Cl_3HC, this into methylen-chloride Cl_2H_2C, this into methyl-chloride

ClH_3C, and this last, as already stated, into marsh-gas H_4C. Some halogen derivatives of marsh-gas appear, but are not altogether proved, to exist in two or more isomeric forms. The existence of two chlorides of methyl, and of three chlorides of methylene, is easily conceivable on the assumption that one pair of hydrogen atoms in marsh-gas represents the oxygen of carbonous oxide, while the other pair represents the more loosely combined excess of oxygen in carbanhydride, as indicated by the following formulæ:

H_2H_2C $\begin{cases} ClHH_2C; & H_3HClC; \\ Cl_2H_2C; & ClHHClC; \text{ and } H_2Cl_2C. \end{cases}$

CONTRIBUTIONS TO THE HISTORY OF METHYLIC ALDEHYDE.*

By A. W. HOFMANN, LL.D., F.R.S.

"The aldehyde of the methyl-series is not known;" all the chemical manuals say so, and for the last twenty years my students have been duly informed thereof. It will scarcely appear strange that more efforts to become acquainted with that body should not have been made, since the masterly picture which Liebig has delineated of the aldehyde *par excellence* embraced as it were the history of the whole class, and of course also of the aldehyde in question. Nevertheless methylic aldehyde deserves our consideration for more than one reason. As one of the simplest terms of the monocarbon-series, occupying a position intermediate between marsh-gas and carbonic acid, as a link of transition connecting methylic alcohol and formic acid, as either aldehyde or acetone, according to the point of view from which we look upon it, the compound CH_2O illustrates a greater variety of relations than any one of the higher aldehydes. But in addition to the interest with which the methyl-compound has thus always been invested, this substance possesses special claims upon our attention at the present moment. Our actual method of treating organic chemistry for the purposes of instruction almost involves the necessity of starting from the methyl-series. The simplest of aldehydes thus acquires quite an especial importance, and all those who, like the author of this note, are engaged in teaching, cannot fail to have sadly missed a compound which is the carrier of such varied and interesting considerations.

The desire which I have frequently felt in my lectures of developing the idea of the genus aldehyde, when speaking of the methyl-compounds, has more than once induced me to attempt the preparation of methyl-aldehyde, but it was only at the conclusion of my last summer course that I succeeded, to a certain extent at all events, in attaining the object of my wishes.

A substance possessing the composition and the properties of methylic aldehyde is formed with surprising facility if a current of atmospheric air, charged with the vapour of methylic alcohol, be directed upon an incandescent platinum spiral.

The bottom of a strong three-necked bottle, of two litres' capacity, is covered to the height of about five centimetres with moderately warm methylic alcohol. The first neck is provided with a tube descending to the very surface of the liquid; into the second is fixed a loosely-fitting cork, which carries the platinum spiral; the third one, lastly, communicates with the upper end of a condenser, the lower end of which is fastened into a two-necked receiver. This receiver is in its turn connected with a series of wash-bottles, and the last of these communicates with a water-jet aspirator, by which a current of air can be sucked through the whole system.

The apparatus being disposed in this manner, the platinum spiral is heated to redness and introduced into the three-necked bottle. After a few minutes the flameless combustion of the methyl-alcohol begins to manifest itself by the evolution of a vapour powerfully affecting nose and eyes. Gradually the temperature of the apparatus rises, and soon droplets of a colourless liquid are condensed in the receiver. The formation of methyl-aldehyde is now fairly proceeding, and if the current of air be appropriately adjusted, the platinum spiral remains incandescent for hours, and even for days. There is no difficulty in collecting from 50 to 100 grammes of a liquid rich in methyl-aldehyde.

Instead of establishing the current of air by a water-jet aspirator, a pair of bellows may be conveniently employed. I have often used with advantage the bellows of an ordinary glass-blowing table. This mode of proceeding is more particularly adapted to the requirements of the lecturer, who is thus enabled, by simply accelerating the movement of the foot, to enliven the combustion, so as to keep the whole spiral in a state of incandescence. By thus proceeding it happens, however, occasionally that the gaseous mixture in the three-necked bottle is fired; but these explosions are perfectly harmless, the whole effect being the forcible ejection of the loosely-fitting cork which carries the platinum spiral.

The liquid which is being collected in the receiver has all the properties which theory assigns to the aldehyde of the methyl-series, or, more properly speaking, to its methyl-alcoholic solution. When rendered gently alkaline by a few drops of ammonia, and mixed with nitrate of silver, it yields, on gently warming, a silver mirror of unreproachable perfection, which is indeed more readily and more certainly produced than with the aldehyde of the ethyl-series. The reduction in this case is the result of two consecutive reactions; in the first stage the aldehyde yields formic acid, which in the second stage is converted into water and carbonic acid.

On heating the methyl-alcoholic solution of the aldehyde with a few drops of a fixed alkali, the liquid becomes turbid on ebullition, acquires a yellowish colouration, and soon deposits droplets of a brownish oil possessing in the highest degree the peculiar odour of ethyl-aldehyde-resin.

After the observation which I have mentioned it was scarcely doubtful that the product of the slow combustion of methylic alcohol contains the aldehyde of this alcohol in considerable proportion. Nevertheless it appeared necessary to fix the nature of this compound by some numbers. The commencement of the vacations being at hand, there was but little hope of preparing the liquid in sufficient quantity for the purpose of obtaining the aldehyde, which will probably be found to be either gaseous at the common temperature, or extremely volatile, in a state of purity for analysis. Under these circumstances I have been compelled to limit myself to the preparation of an easily accessible derivative of methyl-aldehyde possessing a characteristic composition, and the analysis of which would not be less conclusive than that of the aldehyde itself. The slight solubility and the powerfully crystalline tendencies of the sulphaldehyde of the ethyl-series could not fail to indicate the direction in which I had a right to hope that the object which I was aiming at might be accomplished.

If a current of sulphuretted hydrogen be passed through the methyl-alcoholic solution of methyl-aldehyde, the liquid becomes turbid after a few minutes, and on allowing the saturated solution to stand for some hours, a body of an alliaceous odour begins to be separated at the bottom of the flask. If the liquid be now mixed with half its volume of concentrated hydrochloric acid, and heated to ebullition, it becomes limpid, and solidifies on cooling into a mass of felted needles of dazzling whiteness. These needles fuse at 218°; they are volatile without decomposition. Slightly soluble in water, they are more readily dissolved by alcohol, and still more so by ether. For the purpose of analysis they were recrystallized from boiling water, in order to exclude free sulphur, with which they

* Read before the Royal Society, November 21, 1867.

might have possibly been contaminated. The numbers obtained in the analysis of the crystals unmistakeably establish their nature. The white crystals, as might have been expected, have the composition of the sulphaldehyde of the methyl-series.

$$CH_2S.$$

The analysis of the sulphur-compound fixes, of course, the presence of the corresponding oxygen compound among the products of the slow combustion of methylic alcohol.

A more minute examination of methylic aldehyde and its derivatives remain still to be made. It will be absolutely necessary to isolate the oxygen-term and to determine its vapour-density, in order to ascertain its molecular weight. If we remember the facility with which the aldehydes are polimerized, the question presents itself, whether the aldehyde formed by the slow combustion of methylic alcohol is represented by the formula

$$CH_2O,$$

or a multiple thereof. A similar remark applies to the sulphur-derivative. It deserves, moreover, to be mentioned that a compound isomeric with methylic aldehyde, the dioxymethylene ($C_2H_4O_2$) of M. Boutelrow, is known already; also that a sulphur-compound of the formula

$$CH_2S$$

has been obtained by M. Aimé Girard, who observed that bisulphide of carbon is reduced by the action of nascent hydrogen with disengagement of sulphuretted hydrogen.

In the course of next winter I propose to perform some former experiments on the product of the slow combustion of methylic alcohol for the purpose, if possible, of isolating methylic aldehydes in a state of purity, in order to complete this inquiry.

ON THE IDENTITY OF

PHYSICAL WITH SO-CALLED VITAL FORCES.

A few weeks ago we gave our readers, in considerable detail, the remarks of Professor Tyndall on "Matter and Force," addressed to the working men of Dundee. As a sort of sequel to them, and in part an application of these questions to a special series of phenomena, we give in similar detail the words of Dr. Letheby addressed to the students of the London Hospital, at the opening of the current medical session. Prof. Letheby, it will be seen, did ample justice to the great and almost limitless powers of physical research when applied to subjects of biology, before treated mainly by powerful imagination and fruitless conjecture, and which were so settled to the satisfaction only of individual conjectures.

But Dr. Letheby took, as Professor Tyndall did, a still bolder position, as our readers will see, and drew a sharp line of separation between the possibilities and impossibilities of the application of our knowledge of force and matter. The range of possibility allowed by Dr. Letheby to science will be seen on examination to be much smaller than that of Professor Tyndall.

Three such authorities as Professor Tyndall, Huxley, and Letheby rarely lecture upon the aims and limits of science in such close succession, and such lectures will go far to give some definition to the present crude and indefinite popular ideas upon what philosophers think of the range of the various sciences.

Dr. Letheby writes as follows:—"We speak of healthy and unhealthy seasons, and in popular discussion are satisfied to refer the pandemic tendency of disease to the state of the weather. But how are they related? The circumstance of a higher or lower temperature than usual, a wetter or dryer season, the existence of more or less ozone in the air, the fluctuations of the barometer, &c., are, at present, but coincidences of facts; and they offer no explanation whatever of the etiology of disease. The same is also true of the observations which have been made concerning the local peculiarities of epidemics—as the altitude of a place, the condition of its soil, the water level in it, and the presence of putrid effluvia. All these, as in the last case, are but dimly seen to have an influence on disease. We know nothing of their real agency, and yet the wildest theories have been advanced in respect of them. At one time it is dogmatically asserted that epidemics are due to wet in the soil; at another to the water supply of the place. Now, it is the condition of the air which causes them, and then it is our filthy habits. Out of this confusion order must come, and the first step must be towards the investigation of the real nature of specific contagia. When this is known, and the laws which govern their action are determined, the caprices of epidemics will be explained.

"Nor are we much more advanced in the interpretation of healthy phenomena. The fiction of an Archœus, and the mechanical and chemical theories of life, have given place to the dogma of a vital force; but the recent progress of physical science has done much to dissipate our illusions concerning fictitious entities and mysterious forces. The study of physical phenomena, from a dynamical point of view, has led to the recognition of the fact that there is a definite correlation or mutual dependence of physical forces—'that the various imponderable agencies, or the affections of matter, which constitute the main objects of experimental physics, namely, heat, light, electricity, magnetism, chemical affinity, and motion, are all correlated, or have a reciprocal dependence; that neither taken abstractedly, can be said to be the essential or proximate cause of the other, but that either may, as a force, produce or be convertible into the other; thus heat may mediately, or immediately, produce electricity, electricity may produce heat, and so of the rest.' 'I believe,' says Mr. Grove, from whom I am quoting, 'that the same principles and mode of reasoning might be applied to the organic as well as the inorganic world, and that muscular force, animal and vegetable heat, &c., might, and at some time will, be shown to have similar definite correlations.' This was said almost a quarter of a century ago, and yet we are only just beginning to recognise the truthfulness of his hypothesis. A former teacher in this school, Dr. Carpenter, whose large acquaintance with physiology and physics, especially qualify him for a searching examination of this subject, has fully confirmed the views of Mr. Grove. He has established the fact that there is not only a mutual relation between the so-called vital forces, which are concerned in the growth, multiplication, and transformation of tissues, in secretion, in muscular and other organic motion, and in nervous action, but that there is also a like relation between vital and physical forces. Believing with Mr. Grove that all these forces are but different modes of action of one and the same agency, he contends that the differences of action are due to the material substratum or medium through which it acts; 'that operating through inorganic matter it manifests itself in electricity, magnetism, light, heat, chemical affinity, and mechanical motion; but that when directed through organised structures, it effects the operation of growth, development, chemico-vital transformations, and the like; and is further metamorphosed through the instrumentality of the structures thus generated, into nervous energy and muscular power.' So that it is the speciality of the material substratum, thus furnishing the medium or instrument of the conversion or metamorphism of force, that marks the differences between physical and vital phenomena. I believe that the time is fast approaching when all special entities for the explanation of physical and physiological phenomena, will be dispensed with, when the fundamental conceptions of matter and motion will be found sufficient for their explanation.

"In the case before us, it is not necessary to suppose that a living cell or primordial germ contains within

itself, in a latent form, the whole organising force which is required to build up the future plant or animal. Nor is it necessary to believe that vital force exists in a dormant condition in all matter that is capable of being organised, and that the living cell, in growing and multiplying, evokes and utilises it. It is enough that the cell is the medium for the conversion or metamorphosis of external physical forces into what are called vital actions.

"The external force which the cell chiefly converts is heat; and Dr. Carpenter lays so much stress on the dependence of the organising forces of both plants and animals, on the continual agency of heat, that he regards their vital action as the correlation of it. It might, indeed, almost be said that the special and distinctive attribute of a living organisation is the power of converting heat into vital force. In plants it is entirely exercised in the growth and transformation of tissue; but in animals it is also rendered subservient to the production of nervous and muscular forces; and these manifestations of action are always exhibited in tissues, which retain their original cellular constitution. It is remarkable, too, that no cell has the power of performing two different operations at the same time: thus, says Dr. Carpenter, the *assimilating cells*, whose function it is to convert the raw material supplied by food into organisable *plasma*, exercise little or no chemical transformations; they do not undergo change of form; they do not exert any mechanical or nervous power, and they do not reproduce their kind. So, again, the cells which are specially endowed with the powers of *multiplication*, as well as those which are engaged in *reproduction*, have in each case no other vital endowment. It is the same with the *secreting* cells, and with the cells that are concerned in the production of *mechanical movement*, as the contractile cells of muscular fibrillæ, the ciliated cells of respiratory and other passages. Perhaps, also, it is the same with the cells, or cell-nuclei of the *ganglia*, and extremities of nerves which in all probability are the agents of *nerve-force*. This faculty of exercising but one function at a time is a marked peculiarity of physical forces. If, for example, the force derived from chemical action in a galvanic battery be made to act on a fine platinum wire, it will show itself as *heat*; or if it be conducted through a coil of wire placed around a piece of iron, it will exhibit itself as *magnetism*; or if it be conveyed through acidulated water, it will appear as *chemical action*; but all these manifestations of it cannot be fully exerted at the same time. There is, consequently, a certain quantivalence of action; in fact, the idea of the correlation and mutual dependence of forces, involves the necessity of a certain definite ratio or equivalence of action; for as force cannot be created or destroyed, it must ever be acting in some fixed proportion. If, therefore, the heat and light force received by the plant be converted into vital force during the growth and transformation of tissue, there must be a quantivalence of action, and the force must endure. While the cell lives it is exerted in the manifestations of vital phenomena, but when it dies and decays it is converted into chemical action, and then into heat and sometimes light. In the case of the plant the transformation of heat force is chiefly concerned in the production of tissue; and so also in the animal during the processes of growth and repair; but when the latter engages in the main duties of its existence —the development of motion, it resorts to the affinities of its food, and as these are the embodiments, so to speak, of the light and heat, through whose agency they were formed, it may be said that the functions of the animal body are performed through the agency of cosmical force. The plant is the machine or medium whereby light and heat are converted into the force which forms tissue, and the animal is the machine or medium for changing the affinities of the tissue into other manifestations of force, and finally into heat. The one is accompanied by processes of deoxidation, and the building up of compounds; the other by processes of oxidation and pulling down, but throughout the whole of these changes there is the same force operating through different media.

"It follows from this, that there must be some definite relation between food and animal force. Hitherto it has generally been thought that the nitrogenous element of food is the exponent of its value, and that there is a direct relation between the waste of muscular tissue and the amount of work performed. Attempts have, therefore, been made to estimate the relation by observing the amount of nitrogen excreted, as urea, during exercise of different degrees of activity. The results, however, have shown that, under the best circumstances, the actual work performed exceeds that produced by the oxidation of the nitrogenous constituents of the food and worn out muscle by more than thirty per cent, and in some experiments which were made in 1866, by Drs. Fick and Wislicenus of Zurich, when they ascended the Foulhorn, which is 2,000 feet above the Lake of Brienz, in Switzerland, it was ascertained that the amount of work done in climbing the mountain, exceeded by more than three-fourths that which it would have been theoretically possible to realise from the oxidation of muscle, as indicated by the quantity of urea in the urine. Consequently they conclude that muscular force is chiefly, if not entirely, derived from the carbo-hydrogen of our food, and that the muscle is no more than the machine for the production of motion. Like a steam-engine, it converts the affinities of the oxidised fuel into heat, and then into visible motion. Like it, also, its movements must cause decay and necessitate repair. The nitrogenous constituents of our food are chiefly concerned in this last process, and it is very doubtful whether as much force is not expended in this process, as is afterwards produced by the oxidation of the worn-out tissues. In the consideration of this subject, however, we must not lose sight of the fact that there is a difference between sustained and temporary muscular activity. The herbivora, as the horse, the chamois, the stag, &c., are capable of great temporary exertion, but they are not equal to the carnivora for sustained energy; and with our own domestic animals, we find that they are capable of performing most work when they are supplied with vegetable food containing much nitrogen.

"Lastly, I will remark, in illustration of the general tendency of physiological pursuits, that great efforts are being made to determine the constitution as well as the composition of the fluids and tissues of the living body; for there has long been a desire to understand the way in which the common affinities of matter are controlled by the living cell. Broadly, the chemist has ascertained that the chemical functions of the plant are those of reduction or de-oxidation, whereby carbonic acid and water lose oxygen, the residual elements with the nitrogen of ammonia forming tissues. The functions of an animal, as I have said, are of an opposite nature, for instead of building up they pull down; and in using the tissues of plants as food they oxidise them, and finally restore them to nature as carbonic acid, water, and ammonia. 'The two extremes of these changes are,' to use the words of Gerhardt, 'carbonic acid, water, and ammonia, at one end; albumen, gelatine, fat, and cerebral matter at the other;' but the transitions to these extremes are countless, and are as yet almost beyond the ken of science. Who can tell us by what series of transformations the carbonic acid and water, received by the plant, are converted into vegetable acids, sugar, and fat? And still more mysterious are the phenomena which accompany the formation of tissues. Why is it that a living-cell, as we call it, possesses the power of transforming cosmical forces, light and heat, into cell-force; and in aggregating matter, how is it that it keeps common affinities at bay? That when it dies, as we express it, the matter so aggregated during life, decays, and comes again within the reach of ordinary affinities? What answer can we give to these questions? No other than that organic matter is the designed or appointed medium of these changes; and we can no more explain the phenomena than we can

say why it is that mineral matters are the appointed media of other manifestations, as light, heat, magnetism, and electricity. Such questions are beyond the scope of the human intellect, and mark the limit of our understanding.

"Apart from these questions, however, the chemist has hope that he will penetrate the mystery of organic changes, in so far as the chemical combinations are concerned. Already he has found the clue to many of the vegetable processes of reduction, and has been able to produce a large number of organic compounds from carbonic acid, water, and ammonia, and even from the elements themselves: in fact, of the three great classes of alimentary substances, as Dr. Odling says, the production of the oleaginous is quite within his reach; the saccharine is almost within it; but the albuminous is still far beyond it. He has thus proved that the dogma of a vital-force, which has tyrannised so long over men's minds, has no foundation; for a host of organic compounds can be made artificially.

"And then with regard to the processes of oxidation, which characterise the functions of animals, he has been able to imitate them to a much larger extent; for, by subjecting organic compounds to chemical transformations he has produced a multitude of secondary products like those of the living world; recognising the fact that all secondary products of tissue-transformation are compounds of comparatively simple molecules, from which the elements of water have been eliminated—in other words that they are composed of the residues of other molecules, the chemist has been able, not only to classify them into certain definite groups, but he has also been able to construct them after the fashion of organic nature. *Stearin* has been produced by joining the residues of glycerine and a fatty acid. *Sarcosine*, which is a muscle-product, by putting together the residues of acetic acid and methylamine. *Hippuric acid*, from the residues of benzoic acid and glycosine. *Taurine*, which is a constituent of bile, from the residues of isethionic acid, and ammonia. *Urea*, from the residues of carbonic acid and ammonia, and so of many others.

"In this way 'organic chemistry has achieved,' as Dr. Odling truly observes, 'a great *analytical* success. The compounds so elaborately built up by the living organism, it has pulled to pieces, and the pieces themselves it had arranged into natural series and groups of associated bodies.' It has also effected *synthetical* processes, and has built up organic compounds from mineral elements; and its hopes are that the entire processes of organic nature, short of making tissue, will ere long be seen and imitated. Presumptious man! it may be thought, are you not striving for the impossible? In these explorations of vital phenomena, are you not trespassing upon holy ground? Can the finite measure the depths of the infinite? Already we have done so. "The being of a day has pierced backwards into primæval time, deciphering its subterranean monuments, and inditing its chronicle of countless ages. In the rugged court and shattered pavement of our globe, he has detected those gigantic forces by which our seas and continents have changed places; by which our mountain ranges have emerged from the bed of the ocean; by which the gold and silver, the coal and the iron, and the lime, have been thrown into the hands of man as materials of civilisation, and by which mighty cycles of animal and vegetable life have been embalmed and intombed.' 'He has ascended the Empyrean, and by steps of physical research, has reached the visible boundaries of the universe, and has scanned with eagle-eye the mighty creations in the bosom of space. He has marched intellectually over the mosaics of sidereal systems, and has followed the adventurous Phæton in a chariot which cannot be overturned.' 'Ideas like these, when first presented to a mind thirsting for knowledge, are apt,' says Sir David Brewster, from whom I am quoting, 'to disturb its equilibrium and unsettle its convictions. Should this be the mental condition of any one of you, be not alarmed for its results, for this species of scepticism is the infant condition of the uncurbed and generous intellect. There can be no convictions where there have been no perplexities and doubts; and that faith which comes in the train of early scepticism will finally rest upon an immovable foundation.'

"'Credulity, on the contrary, is a disease of feeble intellects and ill-regulated minds. Believing everything, and investigating nothing, the mind accumulates errors, till its overgrown faith o'er-masters its untutored reason. Such a facility of belief may in some cases claim the sympathy even of philosophy; but when it spurns the strict demands of inductive truth, and plants imagination at the door of the temple of science, it cannot be too severely reprobated, or too sternly shunned.'"

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

MICROSCOPICAL AND NATURAL HISTORY SECTION.

November 4th, 1867.

J. Sidebotham, Esq., in the Chair.

The Rev. J. E. Vize showed and presented to the section four specimens of insects beautifully mounted in balsam by himself.

Mr. Sidebotham read the following "*Note on the Ship-barnacle*":—

On the 28th of September I was at Lytham with my family. The day was very stormy, and the previous night there had been a strong south-west wind, and evidences of a very stormy sea outside the banks. Two of my children came running to tell me of a very strange creature that had been washed up on the shore. They had seen it from the pier and pointed it out to a sailor, thiuking it was a large dog with long hair. On reaching the shore I found a fine mass of barnacles, *Pentalasinus anatifera*, attached to some staves of a cask, the whole being between four and five feet long. Several sailors had secured the prize, and were getting it on a truck to carry it away, The appearance was most remarkable, the hundreds of long tubes with their curious shells looking like what one could fancy the fabled Gorgon's head with its snaky locks.

The curiosity was carried to a yard where it was to be exhibited, and the bellman went round to announce it under the name of the sea lioness, or the great sea serpent.

I arranged with the proprietor for a private view, took my camera and a collodio-albumen plate, and obtained the photograph I now exhibit. The afternoon was very dull, and the plate would have done with a little longer exposure, but this, along with the specimens I show, will give some idea of the strange appearance of this mass of creatures.

This barnacle is of interest as being the one figured by Gerard as the young of the barnacle goose. As some of our members may not have seen the book and read the quaint description, I have brought my copy of Gerard's Herbal for their amusement.

I may just mention that another mass of barnacles was washed up at Lytham, and also one at Blackpool, the same day or the day following. I did not see either, but, from description, neither was so fine as the one I have described.

This mass of barnacles was evidently just such a one as that seen by Gerard at the Pile of Foulders. It is rare to have such a specimen on our coasts. The sailors at Lytham had never seen anything like it, although some of them were old men who had spent all their lives on the coast.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESEPONDNT.)

PARIS, Dec. 4, 1867.

Chalices and Patera of Aluminium Bronze—Alloy of Silver and Aluminium, "tiers-argent"—Induction Coil Experiments—Reaction of Iodine, Mercury, and Zinc—Eruption of Vesuvius.

THE Bishop of Dreux Brize formerly applied for chalices of aluminium, either pure or mixed with other metals, to be used on account of their lightness, beauty, and solidity. This demand was not responded to favourably at first, but M. Paul Morin, after many attempts, succeeded. Chalices and patera in aluminium bronze, forbidden by a decree of 5th August, 1865, have been accepted on the condition that the cups of the chalices and the patera be first silvered and then gilt in the portions prescribed by the rubric. We do not doubt that this favour will be soon extended to chalices and other objects in aluminium, alloyed with a third of silver, which gains ground every day, and will become very popular in spite of the obscurity in which the jury of the Exposition have left it. It is, as its name indicates, "tiers-argent," an alloy of one-third silver with two-thirds of aluminium, that has been rendered homogeneous, at first with much difficulty, but now of easy fabrication. The selling price is 90 francs the kilogramme, and the old metal is re-purchased at 75 francs. The spoons, forks, and salvers of this alloy leave nothing to be desired; it possesses a hardness superior to that of silver, and it can be more easily engraved. If we are well informed, the idea of the "tiers-agent" belongs to M. Alfred Talabreau, the inventor, along with his brother of bituminised tubes celebrity. M. De Ruolz, associated at a later period with this new industry, remains the possessor of it, and carried on the business with M. Moustet, successor of Lebrun, 116, Rue de Rivoli.

M. Rondel, of Brive, communicates to us the following:—If, while the current of a pile passes through the primary wire of a coil, one of the extremities of the secondary wire is brought near one of the extremities of the iron core, sparks can be drawn of remarkable intensity and brilliancy; if, at the same time, the other end of the secondary wire is put in communication with one of the poles of the pile, a great increase takes place in the brilliancy of the spark. Then, on touching with the hand the iron core, and placing the free end of the wire in contact with the skin, a redness takes place, and a smart stinging sensation is felt. This last experiment was made upon a coil the core of which, completely isolated in a tube of varnished glass, was eight millimetres in diameter.

M. Rondel made the same experiment with another bobbin, the soft iron of which was 12 centimètres long, 5 centimètres wide, and 8 millimètres thick. The sparks were produced with detonations. A single Bunsen element of small size was sufficient to produce these phenomena.

When two recipients are charged with mercury and water, and fragments of iodine are added, we do not perceive any effect. But if a small piece of zinc is allowed to fall into the mercury, the fragments of iodine are instantly set in motion, and are rapidly dissolved. This solution poured off clear serves for many uses. M. Rondel has employed it concentrated for the supplying of a pile mounted in a closed flask, also for the preparation of a fine red iodide of mercury.

Signor Giordano writes to us from the Naples University, with respect to the present eruption of Mount Vesuvius—

"There is a new conflagration of Vesuvius; I have made several excavations there, and I have just returned at this moment; and faithful to my old habits I hasten to describe what has passed from the first instant of the irruption to the present time.

"After the irruption of last year the volcano remained in the most perfect tranquility. But on the 13th of this month, at 1 o'clock in the morning, without any previous warning, and only with a slight noise, the mountain commenced to project, at first incandescent stones, and afterwards liquid matter by four igneous openings, or craters properly so-called. Neither I nor any other person could positively affirm whether these craters were opened simultaneously or one after the other, and in what order, as no person was on the volcano at that hour, and the first visitors only ascended at an early hour on the following day. The first of these craters is placed at the east of the two cones of last year; the second at half the height of the great cone to the S.E. on the side of the village of Boscoviale; the two other smaller ones on the current of the lava of last year. Only the second of these craters rejected melted matter, that is to say, a current of lava which by degrees spread and filled up the cavities of the plateau at the summit of the mountain.

"If we judge by the effects produced, the commencement of the irruption from the first instant must have been very strong, although neither the sound nor the earthquake were prolonged to a great distance, because the whole of the surface of the great cone presented long crevasses in different directions. Thus, it was feared that the irruption would be neither feeble nor of short duration. And, in reality, in three days all the crater was filled with lava up to the night of the 16th and 17th, when it commenced to flow over in the currents on the external side of the cone towards the north and north-west; thus were three currents flowing at the same time, uniting together at 20 or 30 meters distance from the edge. These currents encumbered the passages most convenient for ascending and descending the mountain, and the visitors were of course more obstructed than ever.

"At present the stream of lava does not advance any further, but the four above-mentioned cones, and a fifth, which has just appeared, are in violent eruption. The central cone has gained much in height, so as to attain the ten meters which separate its base from the edge of the great crater, so that it can be plainly seen from Naples, towering above the summit of the mountain. The substance of the lava is always the same, that is to say, *augitophyre*, and all the ground in the environs of the small cones is covered with the ordinary chlorides of different colours."

F. MOIGNO.

NOTICES OF BOOKS.

A Progamme of Atomechanics; or, Chemistry as a Mechanics of the Panatoms. By GUSTAVUS HINRICHS, Professor of Physics, Chemistry, and Mineralogy at the Iowa State University; Chemist of the Geological Survey of Iowa, &c.

IT must be confessed that scientific men in Europe are not, as a rule, accustomed to look to America, or rather to Americans, for new lights in science, and when such lights appear on the American horizon, it is generally found that the philosopher is a foreigner. Americans appear to be too eager for an immediate and material return for their intellectual capital to devote themselves to the more recondite forms of scientific speculation. That Americans are *capable* of any amount of work of mind or body, that they are eminently clever and ingenious, we freely admit, but few will even attempt to deny that American scientific literature does not, as yet, hold so high a position as might be desired. It is therefore with great interest that we receive any contributions to science emanating from that great country. That the public feeling in America is against us we are unfortunately aware; and this dislike to England takes, among many others, the form of underrating English science, and, whenever possible, French or German models are used by professors to hold up to the study or

emulation of their pupils. Being aware of this, and knowing also that in England we not only bear no animosity to America, but are anxious to cultivate her friendship, we are very unwilling to criticise too harshly any scientific treatise emanating from our brethren on the other side of the Atlantic. But the name of the author of the work, the title of which we have quoted above, is so obviously German that we trust we may indulge in a few remarks upon his treatise (so long as we keep within the limits of fair criticism) without hurting the susceptibilities of any of our American brethren.

The author of this work has sent us a printed sketch of his production, but we may at once confess that the materials before us are insufficient to induce us to follow his argument in detail, and we can therefore only lay them before our readers accompanied by such comments as naturally present themselves.

The author includes in his "Programme" some historical remarks, and he especially states that he made the discovery of "Pantogen" in 1855 when studying at the Polytechnic School of Copenhagen. This pantogen, or "Urstoff," as M. Hinrichs writes it in German, is, in fact, the one primary or truly elemental matter of which all the so-called elements of the chemist of the present day are made up. It is almost impossible within the limits of an article like this to state the reasons which the author gives for assuming the existence of pantogen; and then for concluding that, by assuming the existence of one primary elemental matter, and calling it by a specific name, he has discovered this only true element.

It is needless, perhaps, to say that, like all discoverers of this class, he falls back continually on "analogy." This too free use of analogy has been the bane of science from the time of Plato, and it would appear that the race of speculators who mistake fanciful analogies for fundamental scientific laws is by no means yet extinct.

M. Hinrichs finds that "the history of science is one and the same," and that "we may therefore learn the history of chemistry by studying that of her elder sister, astronomy." He also finds that:—"*Lavoisier* is the *Copernicus* among chemists; both pierced the veil of appearances, and discovered the true order of things. Copernicus found the earth too insignificant to move the heavens. Lavoisier found the metal lighter than its ash (oxide). *Modern chemistry*—not the chemistry of most of our text-books—is truly *Keplerian*. The beautiful laws of *Dulong* and *Petit* (specific heat of the atoms), of *Gay Lussac* (volume of atoms), of Mitscherlich (on isomorphism), &c., were grasped by *Gerhardt* (chemical types), and now make modern chemistry an exact science. The great discoveries in organic chemistry, from *Liebig* to *Berthelot*, and the spectral analysis of Bunsen and Kirchhoff, have made the domain of chemistry as universal as that of astronomy.

"We may venture to conclude that this parallelism in the history of astronomy and chemistry does not end here. The history of astronomy since 1619, when Kepler's third law was discovered, may teach us what changes await modern chemistry.

"We must conclude from this analogy that there exists some general principle which will transform modern chemistry into a *mechanics of the atoms*; for about fifty years after *Kepler* astronomy had become a mechanics of the heavenly bodies, *i.e.*, of *cosmical atoms!*

"The basis of this celestial mechanics (as Laplace so fitly termed astronomy) is but a *hypothesis*,—that of universal gravitation,—which essentially consists in the affirmation that the heavenly bodies only differ in regard to the amount or quantity of matter.

"Let us have the boldness to pronounce a similar hypothesis in regard to the chemical atoms. Let us suppose that the atoms of the different elements only differ in regard to *quantity*—that is, in regard to the *number* and relative *position* of the atoms of some *one* primary matter, just as the planets only differ according to the *number* of kilogrammes of ponderable matter they contain, and its distribution around their axes. Since everything thus would be composed of this *one* pri mary matter we call it *pantogen*, and its atoms *panatoms*."

We have felt bound to give this long quotation in order to show the method adopted by our author, and the way in which "pantogen" was "disco vered."

It must not be supposed for a instant that what we have said gives more than an excee dingly minute idea of our author's "Programme." By ass uming the hypothesis of pantogen he is enabled to expla in and calculate all the physical, chemical, and morpho ogical properties of the elements and their combinations, which *may be calculated* just as the orbit of a planet is calculated. He is also enabled to ascertain the atomic co nstitution, and from them to calculate the *atostere* (specific volume), fusing and boiling point, refracting power, and, to some extent, spectral lines. From all this it is obv ious, we think, that M. Hinrichs' work is by far the m ost wonderful production of modern times, and its au thor certainly the most remarkable man in his adopte d country. It is then then with feelings of profound a stonishment that we learn that the author's paper contain ng the first instalment of his researches promised to the world on page 4 of his "Atomechanik," was refused admission into *Silliman's Journal*, although the MS. only contained 31 pages large quarto! His second paper "On the Trimorphism of Titanic Acid," met the same fa e, "only more so."

How M. Hinrichs arrives at l iis results we do not know until we see his work. We m ust confess that from the slight glimpse we obtain of his mental process, as seen in his "Programme," we fancy th at the results are obtained by arguing backward and writi ng forward. He confesses to using principally "the metho d of successive approxima tions." To deduce all the phy sical characters of a sub stance with the aid of the hypot hesis of pantogen must tax the resources of this method somewhat severely. The mere fact that the addition of C $_2H_4$ to a group in one case *raises* its fusing point 2°, and tl iat the addition of C_3H_6 in another case *reduces* it 4°, mus t, we think, be somewhat difficult to explain, even by o ne who has the "Atome chanik" at his fingers' ends; l ut there is one feat which cannot, we feel sure, be bey ond the resources of the author of the work alluded to, and if he only accomplish it we will "pronounce" at o nce in his favour, and in stantly send in our adhesion t o the new theory; the feat we allude to is simply to isolat e pantogen.

AGRICULTURAL CHEMISTRY.

I. *Report of some Experiments carried out in the Laboratory of the Royal Agricultural College.* By Arthur H. Church, M.A. Oxon, F.C.S. (Practice with Science, vol. i., series ii., No. 6).

II. *Report of Experiments on the Solubility of Phosphates.* By R. Warrington, jun., F.C.S., Assistant to the Professor of Chemistry, Royal Agricultural College, Cirencester, (Practice with Science, vol. i., series ii., No. 4).

III. *Notes on some of the Circumstances which determine the Agricultural Value of Natural Phosphates, with a brief account of the present Method of Analysing them.* By R. Warrington, jun. (Practice with Science, vol. i., series i., No. 7).

IV. *On the Capillary Action of Soils.* By John Wrightson, F.C.S., Professor of Agriculture in the Royal Agricultural College, Cirencester (Practice with Science, vol. i., series ii., No. 3).

We have given, nearly in order of importance, the headings of the various papers which give a summary of the researches that have been carried on, during the last few years, by the different chemists connected with the Cirencester Agricultural College. The papers will be found in full in the 1st volume of "Practice with Science"*—a work of agricultural papers—vol. i. and Dyer. 1867.

* Practice with Science—a series London: Longmans, Green, Reader

capitally printed, indexed, and arranged, as fit to be placed on the drawing-room table as on the shelf of the chemist or agriculturalist's library. The 1st volume contains, besides these papers, much valuable matter of a more technical kind. We hope, however, on an early opportunity, to do ourselves the pleasure of noticing separately Professor Church's wheat experiments, by which it is shown how to estimate tolerably, by a cursory inspection and examination, the various ratios of starchy to nitrogenous matter contained in wheat grains.

The highly ammoniacal Peruvian guano was examined by Professor Church in the three following ways :—1 was a specimen quite fresh ; 2 was dried at 100°, when more than 50 per cent by weight was lost ; 3 was examined after being kept for a few months. The ammonia from the 1st experiment was ascertained to be 20·55 per cent, corresponding to 16·92 per cent of nitrogen calcium ; and magnesium phosphates, 16·98, with a quantity of P_2O_5, in the alkaline estimation, equivalent to ·79 per cent. The ammonia lost by experiment No. 2 amounted to 10·49 per cent, leaving thus a percentage of nitrogen of 7·72, as compared with 16·95 given by the 1st experiment. After 12 months' keeping the nitrogen amounted to only 9·08 per cent, as compared with the nitrogen contained in the 1st sample ; this shows a loss of 7·87 of nitrogen by 12 months' keeping. Professor Church remarks that this fact points strongly to the probable advantage to be derived from fixation by the sulphating process of such guanos.

In an analysis of acorns, upon which Professor Church informs us, horses and sheep will feed readily, the kernels, husks, and entire acorns were examined. The kernels contain 3·08 per cent of albuminoids, compared with 1·83 in the husks, starch, cellulose, and sugar ; 47·17 in the kernels, as opposed to 44·33 in the husks ; while the husks gave 26·59 per cent of insoluble fibre, the kernels 2·58 only. This large proportion of calorifacient food is sufficient, we think, to justify Mr. Church in a series of determinations of their comparative economic use, and also for settling to what cause the harsh flavour of the kernel is to be assigned, and whether this drawback could be removed by any simple process. Acorns and horse-chestnuts may yet, by judicious chemical treatment, be sources of profitable nutriment.

As regards the alleged value of spentgalls from chemical works as a manure for market garden crops, from a sample supplied by Messrs. Hopkin and Williams, Prof. Church does not give much hope. "At present it would be premature to affirm that they are worth purchasing at all." The value seems to be either mechanical upon certain soils, or chemical merely from the carbolic acid evolved during putrefactive decay.

Sugar boilers' scum, on the other hand, affords much calcium phosphate and an appreciable quantity of nitrogen. This scum may be obtained in large quantities and at a cheap rate.

Apropos of Farnham, of workhouse celebrity, our readers will doubtless recollect that before the current month, the place was celebrated for its interesting formations of greensand and gault, and the commercial working of the coprolites there into phosphatic manures. The question of the applicability of these fossil excreta to manure, has gained much attention, and thus Professor Church was induced to examine for them the junction of the greensand with the upper chalk in Wiltshire, near Calne. They were found to contain very much calcium carbonate, a larger quantity of sulphuric acid being thus required for their manufacture into manure. It is estimated, in the paper under notice, that these Calne coprolites are worth about 28s. per ton ; referred to the standard of those of Cambridgeshire, the latter show a value of 40s. per ton ; the phosphates here are equal to about 55 per cent of tricalcic phosphate.

In the succeeding paper Professor Church finds that from the improved method of extraction of the oil from hard kernels, only about 20 per cent of oil remains in palm-nut kernel meal (in one case 17 only), as compared with 26 and upwards found some time ago by Dr. Vœlcker.

The last of this interesting series of chemical research is in some respects the most interesting of all. The injurious effects of mangold leaves in feeding young animals induced Professor Church to try and find the cause of this. The method of conducting the experiment is given in detail, and further researches we hope will be instituted, from the value already gained Mr. Church arrives at the determination, that 100 lbs. of fresh mangold leaves contained rather more than 4 ounces of the soluble acid oxalate of potassium ; with the remark that in dry seasons this amount may be possibly increased. This must conclude the 1st part of our notice of these interesting chemical papers. They only require an attentive perusal for their great and full value to be mmediately recognized.

(To be continued.)

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Sulphochlorbenzolic Acid, and Derivatives of.—R. Otto and L. Brummer. Chlorinated or brominated substitution compounds of benzol or toluolsulphurous acid cannot be obtained by the direct action of chlorine or bromine, but may be prepared by treating chlorinated sulphobenzolic (or toluolic) chloride with sodium-amalgam. The reaction takes place according to the equation :

$$\left.\begin{matrix} C_6H_4ClSO_2 \\ Cl \end{matrix}\right\} + 2Na = \left.\begin{matrix} C_6H_4ClSO \\ Na \end{matrix}\right\} O + NaCl$$

Sulphochlorbenzolic acid is obtained by dissolving chlorobenzol in sulphuric acid, neutralising with plumbic carbonate, and decomposing the plumbic sulphochlorbenzolate with sulphuretted hydrogen. The aqueous solution of the acid is evaporated on the water-bath, and the syrupy mass thus obtained becomes crystalline on cooling. It is readily soluble in alcohol, insoluble in ether and benzol. Its formula is :

$$\left.\begin{matrix} C_6H_4Cl \\ SO_2 \\ H \end{matrix}\right\} O$$

On acting upon the sodic salt with phosphoric pentachloride, sulphochlorbenzolic chloride,

$$\left.\begin{matrix} C_6H_4Cl \\ SO_2 \\ Cl \end{matrix}\right\}$$

is formed ; it crystallises well, fuses at 50—51°C., is insoluble in water, soluble in ether and benzol ; it dissolves in alcohol with formation of its ether. Fuming nitric acid converts the chloride into nitrosulphochlorbenzolic acid ; alcoholic ammonia into the amide

$$\left.\begin{matrix} C_6H_4ClSO_2 \\ H_2 \end{matrix}\right\} N$$

—nascent hydrogen into chlorphenylic sulphhydrate, according to the equation :

$$\left.\begin{matrix} C_6H_4Cl \\ SO_2 \\ Cl \end{matrix}\right\} + 6H = \left.\begin{matrix} C_6H_4Cl \\ H \end{matrix}\right\} S + HCl + 2H_2O$$

The sulphhydrate forms beautiful large crystals which are soluble in ether, benzol, and hot alcohol, insoluble in water, add fuse at 53—54°. It is converted into chlorphenylic disulphide on being gently heated with nitric acid :

$$2\left\{\begin{matrix} C_6H_4Cl \\ H \end{matrix}\right\} S + O = \left.\begin{matrix} C_6H_4Cl \\ C_6H_4Cl \end{matrix}\right\} S_2 + H_2O$$

This sulphide crystallises well, is insoluble in water, soluble in ether and hot alcohol, and fuses at 71°; it may be reconverted into the sulphhydrate by nascent hydrogen. Chlorbenzolsulphurous acid is converted into sulphochlorbenzolic chloride on being treated with chlorine, and into chlorbenzylsulphhydrate (identical with the mercaptan from sulphochlorbenzolic chloride) when subjected to the action of nascent hydrogen.—(*Ann. Chem. Pharm.* cxliii. 100.)

Oxyethylendisulphonic Acid and New Formation of Isethionic Acid.—Th. Meves. The author prepares isethionic acid by the following method:—Equal weights of dehydrated baric sulphovinate and sulphuric anhydride are mixed together, and the mixture is heated on the water-bath after the first violent reaction is over. The black mass thus obtained is dissolved in water, the solution boiled for several hours, and, after dilution, neutralised with baric carbonate, filtered, and the filtrate precipitated with potassic bicarbonate. The filtrate thereof is evaporated to dryness, and extracted with alcohol, which dissolves potassic isethionate. Oxyethylendisulphonic acid is obtained by the action of sulphuric acid on isethionic acid according to the equation:—

$$(C_4H_5O_2)[S_2O_4]O.HO + S_2O_6 = (C_4H_4O_2)\begin{pmatrix}S_2O_4\\S_2O_4\end{pmatrix}O_2.2HO$$

It is prepared by heating one part of potassic isethionate with three parts of fuming sulphuric acid, dissolving in much water, and neutralising with baric carbonate. The baric salt is converted into the potassic salt, and the latter crystallised out. The free acid obtained from this by decomposition with sulphuric acid forms a syrupy liquid of strong reaction which does not crystallise.—(*Ann. Chem. Pharm.* cxliii. 196.)

MISCELLANEOUS.

The Royal Society.—At the anniversary meeting on November 30, 1867: the following elections took place, *President.*—Lieut.-General Edward Sabine, R.A., D.C.L., LL.D. *Treasurer.*—William Allen Miller, M.D., LL.D. *Secretaries.*—William Sharpey, M.D., LL.D.; George Gabriel Stokes, Esq., M.A., D.C.L., LL.D. *Foreign Secretary.*—Prof. William Hallows Miller, M.A., LL.D. *Other Members of the Council.*—Frederick Augustus Abel, Esq.; William Benjamin Carpenter, M.D.; Prof. A. Cayley, LL.D.; J. Lockhart Clarke, Esq.; John Evans, Esq.; Capt. Douglas Galton, C.B.; John Peter Gassiot, Esq.; John Hall Gladstone, Esq., Ph. D.; Sir Rowland Hill, K.C.B., D.C.L.; William Huggins, Esq.; Thomas Henry Huxley, Esq., Ph. D.; Prof. John Phillips, M.A., LL.D.; Prof. Andrew Crombie Ramsay, LL.D.; Colonel William James Smythe, R.A.; Lieut.-Col. Alexander Strange; Thomas Thomson, M.D.

Obituary.—We have to record the death of Dr. Thomas Clark, late Professor of Chemistry in Marischal College, Aberdeen: his decease occurred on the 27th November, at Clydeview. Dr. Clark's methods of testing and purifying water are well known. The soap test devised by him has been used by chemists for twenty-five years without receiving modification or improvement in their hands. This process for softening water on a large scale is also much used at the present time, and was indeed mentioned by several fellows in a discussion at the last meeting of the Chemical Society. The subject of water seems to have been the one to which Dr. Clark specially devoted himself, and to which almost all his papers in scientific journals refer: his writings have a peculiar charm in them from the modesty with which he expresses himself. Though not a Fellow of the Royal Society, Dr. Clark, had he lived, probably would have been made one at the next election, since his friends were circulating a certificate for signatures.

Royal Institution of Great Britain.—At the General monthly meeting, Monday, December 2, 1867. Sir Henry Holland, Bart., M.D., D.C.L., F.R.S., President, in the chair. George Willoughby, Esq., M.I.C.E., F.R.G.S., William Daniel Michell, Esq., and Morgan Bransby Williams, Esq., M.I.C.E., were elected members of the Royal Institution.

Professor Naquet.—M. Naquet, the distinguished Professor of Chemistry of the Paris University, who was lately arrested for political reasons, has been transferred from Mazas to a *maison de santé*, on the intervention of Dr. Wurtz, the Dean of the Faculty of Medicine. The very valuable work of M. Naquet has lately been translated into English, and published, by Mr. Cortis of Guy's Hospital. M. Naquet is a great favourite with the students, and a very accomplished man of science. His arrest for political reasons has caused a sensation of deep pain in the faculty and schools of Paris.—*British Medical Journal.*

New Reflecting Telescope to be used at Melbourne, Australia.—The Rev. Dr. Robinson, F.R.S., gives the following description of the new Reflecting Telescope recently made for the Melbourne Observatory, in a letter to the President of the Royal Society. "As you express a wish to know my recent impressions respecting the great telescope, I can say that they are very satisfactory. When I saw it six weeks ago the first of the two great specula was just polished; and though the essential parts of the equatoreal were in position, and one could estimate the facility with which it could be managed, the optical part of the telescope remained incomplete. Now, I found the great and small specula in their places, a finder of four inches aperture attached, the circles divided, and the clock for driving the telescope enshrined in the pier. One thing was wanting, weather fit for trying its power; and during eighteen nights there was only one of even middling goodness. That, however, was sufficient to prove that the instrument is thoroughly up to its intended work. I examined several nebula and clusters, with whose appearance in Lord Rosse's six-feet reflector I am familiar, and the difference was far less than I expected. I may specify among them 51 Messier, whose spirals were seen on strong aurora and the nebula in Aquarius, with its appendages like the ring of Saturn. Its definition of stars is very good: α Lyræ had as small and sharp an image as I ever saw on such a night; and a few pretty close double stars were well and clearly separated. Part of this is probably due to the lattice-tube, which permits the escape of heated air, but more to the figure of the speculum, which is truly parabolic. The peculiar nature of the mounting brings the circles completely within reach of the observer's assistant; and the mechanical appliances for the motions in right ascension and polar distance are so perfect, that we set the instrument on the faint objects which we were examining with great facility and rapidity. One man can reverse the telescope in a minute and a quarter; the quick motion in polar distance is of course far easier, and the slow one acts more like the tangent screw of a circle than the mover of such a huge mass. The clock is rather gigantic, but does it works with great precision, the objects which I examined remaining steady on the wire as long as I watched them; and there is an ingenious and new contrivance for suiting its speed to planets or the moon. There remain but a few matters to be completed; the second great speculum is nearly polished, the glass small one is ready; the micrometer and observing-chair are not commenced, nor the photographic apparatus and spectroscope. These two last are no part of Mr. Grubb's contract; but the committee thought themselves justified by the correspondence in ordering them, as their cost is small, and they will add greatly to the utility of the telescope. In the fine sky of Melbourne it will, I trust, yield spectroscopic results surpassing any that have as yet been obtained. That it

will realise fully the expectations of the people whose enlightened liberality has ordered its construction I am quite certain; but I am not so certain that it will retain its present perfection very long if exposed without some shelter. It is true that Mr. Cooper's great achromatic has stood exposed to the rain and wind of Connaught for more than thirty years, and is still serviceable; but besides its inferior size it is of coarser workmanship, and is provided with fewer of those beautiful contrivances which in this instrument make its movements so easy. At Melbourne the rain of Markree is not to be feared; but if one may judge from its position on the verge of a great continent, and from the analogy of India and the Cape, another enemy is to be dreaded, the fine dust which winds from the interior will probably bring. This would find its way into all the bearings, and besides clogging their action would grind them out of truth. The danger of this induces me, after careful discussion with Mesrrs. Le Sueur and the two Grubbs, to lay before you my views, which (if you think them sound) you may hold it advisable to mention to the authorities of Victoria. Three modes occur to me of covering the telescope. In any case it must be surrounded by a wall, for the comfort of the observer and to prevent intrusion. This wall may support a moveable covering of such a kind as to let the instrument be pointed to every part of the sky. The most usual form of this covering is a dome running on a circular railway, and with an opening or chase on one side reaching from its base to its summit, and closed by a sliding shutter. The disadvantages of this plan are that the performance of the telescope is somewhat injured by currents of warm air rising through the chase, and that it is much heavier and more costly than either of the others. In this instance its diameter could not be less than 56 feet; and though that magnitude is not beyond the resources of an accomplished engineer, yet it is not one to be encountered without the prospect of some adequate advantage. The largest dome which I know (Sir James South's, of 36 feet diameter) is a total failure; but this does not weigh much with me; for, though planned by the celebrated Brunell, it transgresses against the elements of mechanical science. A much simpler plan is the sliding roof. In this case the walls are rectangular, enclosing a space rather broader than the instrument, and about three times as long. The longer sides carry two rails, on which runs a kind of house long enough to cover the instrument and pier, and high enough to clear the latter. That end which at Melbourne will be its north is closed by doors, which are opened at the time of observation, and the roof is wheeled away, leaving all in the open air. It will be the cheapest and least bulky of the three. Its defects are, that the open end presents some engineering difficulty, that the roof will hide about 12° under the pole, and that the whole machinery is exposed to any dust that may be stirring during the hours of observing. That which appears the best is the revolving roof. Its vertical part is a prism of sixteen sides, six feet high, springing from a ring of cast iron which revolves by rollers on a circular rail borne by the wall. The top is nearly flat, with a chase large enough to let the telescope work freely, which can be covered by sliding shutters. The tube, when in use, would project through the chase, and be essentially in free air, at other times could be lowered and completely sheltered; while the other parts would be as well protected as under a dome. In this case the internal diameter should be about 46 feet, with a chase 16 feet wide. These dimensions would give complete command of the heavens, and such a roof would give less hold to a high wind than either of the others. I enclose a rough sketch of its framing. The pannels and the three girders at the top to be of angle-iron, light but strong, and these covered with tin plate. If it were adopted, I suppose the frame would be made here, sent out in pieces, and put together and covered on its arrival. The weight would be about 5 tons. As to its cost, no estimate can be given, as labour costs more at Melbourne than with us; but in Ireland it would be about £1,200. I will conclude this long letter by telling you how much I am satisfied with our selection of the astronomer who is to work this glorious instrument. He is not a mere mathematician; such a one might be very helpless when he came to the practical details of observing, but he is thoroughly versed in its optical and mechanical requirements, and in the daily work of an observatory. For this last he has been trained by Professor Adams during the past year; one of the Committee, Mr. Warren De la Rue, the first of celestial photographers, has instructed him in the mysteries of that surprising art; and for the last three months he has been constantly in Mr. Grubb's works, studying all the mechanism of the telescope (of which I see he has acquired full command), and taking an active part in the polishing of the great specula. He seems fully to understand this most delicate process; and it is my opinion that, if repolishing becomes necessary, he is fully competent to do it successfully. I may therefore congratulate you in full hope on the inestimable harvest of discovery and triumph which will soon crown this magnificent enterprise."

Utilisation of the Grey Barks.—Mr. Broughton, the quinologist, or quinine chemist, employed by Government at the Neilgherry plantations, has produced pure sulphate of quinine from the *Crispa* variety of the *Cinchona Officinalis*. From his analysis it appears that, although the grey barks do not contain quinine, they are among the richest in their yield of alkaloids. Mr. Broughton is conducting experiments for the determination of the best season for cropping the bark on a large scale, the various methods of drying the bark for exportation, the influence of soil, the physiology of the alkaloids, and the effects of mossing the barks. The question of a ready means of utilising the barks in the form of some simple preparation for therapeutical purposes in India is also receiving his best attention.—*British Medical Journal.*

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent. 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3129. H. A. Bonneville, Rue du Mont Thabor, Paris, "Improvements in the method or means for preserving pasty matters and substances, and apparatus therefor."—A communication from E. Charton, Rue Lepic, Paris.—Petition recorded November 6, 1867.

3208. A. F. Gaidan, Nimes, Gard, France, "Improvements in compressed or artificial fuel."—Partly a communication from L. Tresgot, Nimes, Gard, France.

3219. E. Madge, Swansea, "Improvements in the mode of and apparatus for the reduction of sulphate of iron crystals."—Partly a communication from C. Madge, Carrizal Bajo, Chili.—November 13, 1867.

3226. W. H. Richardson, Glasgow, N.B., "Certain improvements in the manufacture of iron and steel, and in the means or apparatus for effecting the same."

3232. J. Clark, Ph.D., and A. Esilman, Glasgow, N.B., "Improvements in decomposing the sulphides of copper, silver, nickel, cobalt, lead, barium, strontium, and calcium, and in obtaining copper, sulphur, and other products."—Novemer 14, 1867.

3233. R. G. Harcourt, Birmingham, "Improvements in the manufacture and composition of fire lighting material."

3243. A. M. Clark, Chancery Lane, "Improvements in refining copper."—A commnication from F. Le Clerc, M.D., Boulevart, St. Martin, Paris.

3244. J. Templeman Glasgow, N.B., "Improvements in the manufacture of fire-lighters, applicable also for temporary fires or heaters, and in the means or apparatus employed therein."—November, 18, 1867.

3248. J. Swindells, Kegworth, Leicestershire, "Improvements in the process of, and in apparatus employed in treating and separating minerals, earths, and other substances when ground or pulverized."

3269. J. G. Tongue, Southampton Buildings, Chancery Lane, "Improvements in the process and apparatus employed for ageing and refining wines, alcoholis spirits and other liquors."—A communication from R.D.. Turner, New York, U.S.A.—November 16, 1867.

3264. C. E. Brooman, Fleet Street, London, "A new or improved process of and apparatus or furnaces for the manufacture of metal direct from the ore."—A communication from P. E. Martin, Paris.

3270. G. Fitt, Limehouse, Middlesex, "Improvements in the manufacture of artificial manure."—November 18. 1867.

3282. W. H. Richardson, Glasgow, N.B., "Certain improvements in the manufacture of iron and steel."—November 20, 1867.

NOTICES TO PROCEED.

2114. J. Hargreaves, Appleton-within-Widnes, Lancashire, "Improvements in utilizing certain materials or products obtained during the manufacture of steel and iron."—Petition recorded July 19, 1867.

2132. T. A. Breithaupt, Passage des Petites Ecuries, Paris, "Certain processes of manufacturing extract and essence of hop to be substituted for the plant itself in the making of beer."—July 22, 1867.

2166. C. E. Brooman, Fleet Street, London, "Improvements in the manufacture of cast steel and its derivatives."—A communication from E. Martin and P. E. Martin, Paris, July 25, 1867.

2553. J. Eichhorn, Delahay Street, Westminster, "Improvements in furnaces for melting iron and other metals, and for smelting ores."—Partly a communication from H. Krigar, Hanover, Prussia.—September 9, 1867.

2618. T. Bell, Hampstead, Middlesex, "Improvements in treating the oxide of iron residues of gas purifying in order principally to extract sulphur therefrom."—September 17, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

(Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the "Chemical News.")

Comptes Rendus.

September 2, 1867.

Dumas, "Obituary Notice of Professor Faraday." Chevreul, "Obituary Notice of Professor Faraday." Chasles, "Answer to Faugere's Remarks on the Authenticity of the Pascal Correspondence." Secchi, "On a Self-recording Meteorological Apparatus in the Champ Mars." "On the Shooting Stars observed on the 10th of August, 1867." "On a Stellar Spectroscope." A. W. Hoffmann, "On a new Class of Acids homologous with Hydrocyanic Acid." Burdin, "On the Use of Hot Air instead of Steam as a Motive Power." P. Desains, "Researches on the Absorption of Obscure Heat." A. Oppenheim, "New Researches on the Isomerism of Protochloride of Allyl and Monochlorinated Propylene." A. Gautier, "On Chloride of Hydrocyanic Acid." M. Simpson and A. Gautier, "On the direct Combination of Aldehyde and Hydrocyanic Acid." J. Y. Buchanan, "On some Derivatives of Isethionic Acid," Phipson, "On the Presence of Columbite in Wolfram." A. Baudrimont, "On the Chemical Composition of the various Kinds of Guano imported to Bordeaux during the last Twelve Years."

September 9.

Chasles, "Answer to some further remarks by Faugere on the Authenticity of the Pascal Correspondence." A. Secchi, "On the History of the Static Barometer." A. W. Hofmann, "On a new Series of Homologues of Hydrocyanic Acid." Faugere, "Some further Remarks on the Authenticity of the Pascal Correspondence." J. M. Gaugain, "On the Polarisation of the Electrodes of the Voltaic Battery." Berthelot, "On some Hydrocarbons contained in Coal Tar. Styrolene. Cymene. Hydride of Naphthaline. &c." A. Gautier, "On a new Series of Isomers of the Fatty Hydrocyanic Ethers." "On a new Base derived from Hydrocyanic Acid."

Monatsbericht der Königlich-Preussischen Akademie der Wissenchaften zu Berlin.

June, 1867.

Poggendorff, "On the Motion of Quicksilver in Glass Tubes under the Influence of the Electric Current."

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften zu Wien. (Mathematisch-naturwissenschaftlische Classe.)

March, 1867.

G. Tscherma, "On Glaucodote and Danaite."

Bulletin de la Societe Chimique de Paris.

May, 1867.

J. Kolb, "On the Theory of the Manufacture of Soda by Leblanc's Process." Louguinine and Lippmann, "On the Preparation of Cymene by treating Camphor with Perchloride of Phosphorus." P. Alexeyeff, "On Crystallised Nitrotoluol." E. Grimaux, "On the Constitution of Benzoine, Hydrobenzoine, and some allied Substances."

June.

E. Monier, "An Improved Hair Hygroscope." Phipson, "On a Method of Detecting the Presence of Iodine and Bromine in the same Solution." Lecoq de Boisbaudran, "A new Method of Estimating Copper." C. Friedel and A. Ladenburg, "On a Silicic Mercaptan." E. Grimaux, "On the Brominated Derivatives of Gallic Acid." J. J. Chydenius, "On Hexylene-Pseudo-Urea." F. Sestini, "On Wax of *coccus caricæ*." Mallet, "On the Manufacture of Chlorine and Oxygen from Subchloride of Copper." Anthoine and Genoud, "An improved Iridescent Glaze for Porcelain." "A method of Producing Designs on Agate." Paraf-Javal, "On the Transformation of Liquid into Solid Fatty Acids." Fernod, "A Method of treating Garancin."

NOTES AND QUERIES.

Bichloride of Methylene.—Will you be good enough to let me know the best process for making bichloride of methylene, also any tests for its purity?—J. Miller. [Some commercial samples of bichloride of methylene have proved on analysis to be little more than a mixture of chloroform and ether.—Ed. C. N.]

Water for Steam Boilers.—Can any one refer me to a work which gives reliable information upon "Waters" with respect to their suitability for supplying steam boilers, or can you tell me what is the physical character of the deposits when the water contains much sulphate of lime or carbonate of lime?—E.S.T.

Watts's Dictionary of Chemistry.—In reply to a query addressed to us by a Subscriber, we are informed by the Publishers of Watts's Dictionary of Chemistry that there is only one sheet now due to the subscribers to that work, as the thirteenth part contained two sheets more than the proper quantity. The missing sheet will be given in a future part.

The Bichromate Battery.—Can any of your readers refer me to a description of the mode of using the bichromate battery? Is it as well suited as Grove's for use with Ruhmkoff's induction coil? Is it as intense and as constant as that battery? Should the zinc plate of it be amalgamated? In what proportion should the saturated solution of bichromate of potash be mixed with strong sulphuric acid?—Clericus.

Atomic Weight Queries.—(1.) In p. 2 of Frankland's "Lecture Notes" we read that the atomic weight of an element is made to represent as far as possible "the weight of the element in the solid condition, which, at any given temperature, contains the same amount of heat as seven parts by weight of solid lithium, at the same temperature." A reference to Kopp's researches is, I presume, here made. Where can I find information elucidating the above statement? (2.) On comparing the titles of atomic weights in Watts's "Dictionary of Chemistry," vol. i., p. 465, published in 1863, and in Frankland's "Lecture Notes" p. 6, published in 1866, I find a large number of the atomic weights doubled in the latter. The doubling is I believe due to the researches of Cannizzaro. Where can I find an account of these researches? Dr. Odling, in his article on "Atomic Weights," just referred to, speaks of the objections to Cannizzaro's proposal of doubling the atomic weights as being "too great to admit of its adoption." How then has it become so rapidly adopted?—Rusticus.

TO CORRESPONDENTS.

NOTICE.—The Printing and Publishing Offices of the Chemical News *are Removed from Wine Office Court, Fleet Street, to*

BOY COURT, LUDGATE HILL, E.C.

where all Communications are to be addressed.

S. E. Phillips.—We are by no means so materialistic as our correspondent supposes, and shall be very glad to peruse the article named.

D. H.—"Santonine" was a misprint for "Saponine."

J. D. Barry.—Thompson's Dictionary of Chemistry is in one volume. Watts's Dictionary is the most suitable, but it is in four or five volumes.

Rusticus.—1 and 2. See "Notes and Queries." 3. The best elucidation will be found in Wurtz's "Introduction to Chemical Philosophy," published at our office. 4. Not generally adopted. 5. There is no *best* method, strictly speaking. Either mode of formulation meets with supporters, and at present there are not sufficient data to enable one to decide between them.

An Old Subscriber.—Is thanked for his communication, we will endeavour to attend to his wishes. There is sometimes difficulty in getting the requisite permission; we think however, that we may promise the lectures this year.

Books Received.—"Cassell's Popular Educator." "The Reducer's Manual and Gold and Silver Worker's Guide," by Victor G. Bluede. London: Trübner and Co. "American Artizan. "Journal of Gas Lighting." "Bulletin Mensuel de la Société Chimique de Paris." "Scientific American." "Proceedings of the British Pharmaceutical Conference," Dundee Meeting, 1867. "A Catalogue of Photographic Apparatus, Chemicals, &c.," Murray and Heath, Jermyn Street. "The Pharmaceutical Journal" for December. "Mining and Scientific Press." "American Gaslight Journal." "Hardwicke's Science Gossip." Philosophical Magazine" for December. "American Journal of Mining," "A Manual of Pharmacy, for the Student of Veterinary Medicine," By W. J. T. Morton. London; Longmans.

Communications have been received from Dr. Rohrig; Dr. Attfield; Dr. Odling, F.R.S.; W. Spalding; Dr. R. Angus Smith, F.R.S. (with enclosure); F. O. Ward; I. Baggs; H. K. York; Herr Sensolmer (with enclosure); W. White; H. Morris; T. Reader; S. Muspratt; M. Murphy; C. David; J. Mc Dougall; J. Slater; C. Tomlinson, F.R.S.; Herr H. Kunde; J. Grieveson; J. Walker (with enclosure); J. Malcome; H. Johnson; J. Williams; J. O. M. Wallace E. Riley; J. D. B. Fraser; Rev. Edwin Smith; A. Warner; T. Loveridge; Dr. Davy; Dr. S. Muspratt (with enclosure); Carrell and Co; W. Molyneux; T. Smith (with enclosure); C. Dussace; G. Maurice; H. Hayman; J. Thompson; W. Ladd; Professor Morton; Dr. Quesneville; Professor Heaton; C. Greville Williams, F.R.S.; W. Jameson (with enclosure); Rev. C. W. Kett; Johnson and Sons; Dr. Pattison; Dr. Wilhelms.

THE CHEMICAL NEWS.

VOL. XVI., No. 419.

ON GAS ANALYSIS.

By Drs. GRANDEAU and TROOST.

(Concluded from page 272).

IV. Mixture of Hydrosulphuric Acid, Carbonic Acid, and Nitrogen.

HS CO_2 N

The mixture is measured into a graduated tube standing over mercury. Introduce a solution of sulphate of copper, and agitate. The diminution of volume represents the amount of hydrosulphuric acid present.

Professor Bunsen recommends in preference for the absorption of the hydrosulphuric acid, a ball of binoxide of manganese impregnated with phosphoric acid. [To obtain a ball of binoxide of manganese which does not tend by reason of its porosity to absorb other gases besides hydrosulphuric acid, M. Bunsen prepares by levigation a fine powder, which is formed into a thick paste by a little water. This paste is then pressed into a mould round a platinum wire, the extremity of which is twisted into a spiral. The mould is then dried at a gentle heat, when the ball of binoxide is readily detached; for greater precaution, the sides of the mould may be smeared with a little oil. The ball is then moistened several times with a syrupy solution of phosphoric acid].

The remaining gas, transferred to an appropriate tube, is then submitted to the action of caustic potash, which absorbs the carbonic acid. The residue is nitrogen.

V. Mixture of Hydrochloric Acid, Hydrosulphuric Acid, Carbonic Acid, and Nitrogen.

HCl HS CO_2 N

When the exact volume of the mixture has been accurately measured in a tube over the mercury, the hydrochloric acid is absorbed by means of a fragment of hydrated sulphate of soda fixed to the extremity of a platinum wire. [To obtain these fragments it is sufficient, according to M. Bunsen, to fuse ordinary sulphate of soda in its water of crystallisation, and to dip in several times the end of a platinum wire. There attaches to the wire a small lump of the sulphate which augments in volume with each fresh immersion].

Then remove the sulphate of soda, and measure the volume again. The diminution observed will represent the volume of hydrochloric acid gas.

The hydrosulphuric acid is absorbed by a ball of binoxide of manganese soaked in phosphoric acid, and the carbonic acid is afterwards absorbed by potash. The residue gives the nitrogen.

VI. Mixture of Sulphurous Acid, Carbolic Acid, Oxygen, and Nitrogen.

SO_2 CO_2 O N

(Gas issuing from Craters of Solfatara).

The volume of the mixture being measured dry in a graduated tube over mercury, the sulphurous acid is absorbed by a ball of binoxide of manganese impregnated with phosphoric acid. After having removed this ball and noted the diminution of volume, a fragment of potash is introduced to absorb the carbonic acid. The second diminution of volume will give the carbonic acid.

The oxygen can then be absorbed by potash and pyrogallic acid; or it may be estimated eudiometrically as described in No. 1. The nitrogen will remain as residue.

VII. Hydrosulphuric Acid, Carbonic Acid, Hydrogen, and Nitrogen.

HS. CO_2 H N

(Fumeroles of Volcanoes)

Commence by absorbing the hydrosulphuric acid by introducing into the mixture a ball of binoxide of manganese impregnated with phosphoric acid. The absorption of the carbonic acid is then effected by means of a fragment of moist caustic potash.

The hydrogen is then estimated as at No. 2, either by the eudiometer, or by passing the mixture of hydrogen and nitrogen into a curved tube and introducing compact oxide of copper into the upper part of the bend. By heating for a quarter of an hour the part of the tube containing this oxide, the complete absorption of the hydrogen is effected. The nitrogen will form the residue.

VIII. Gas from Blast Furnaces where Wood is used.

CO_2 CO H N

After having accurately measured the volume of the mixture over mercury, absorb the carbonic acid with a fragment of caustic potash.

Then estimate the carbonic oxide by introducing into the graduated tube a solution of subchloride of copper in hydrochloride acid, agitate, and the absorption will be complete.

Instead of introducing the liquid itself it will be better, as M. Bunsen advises, to introduce a ball of papier maché impregnated with this acid solution of subchloride of copper.

This experiment should be made over another separate mercurial trough, for the subchloride of copper attacks and fouls the mercury.

In withdrawing the ball impregnated with chloride, before reading off the volume, it is necessary to remove the hydrochloric acid vapours given off by the chloride.

The estimation of the hydrogen can then be effected as at No. 2, either by the eudiometer, or by absorption with oxide of copper. The nitrogen remains as a residue.

IX. Gas from the Mud of a Pond.

CO_2 CO H C_2H_4 N

First estimate the carbonic acid by means of potash, then with a ball of papier maché introduce into the mixture a concentrated solution of subchloride of copper in hydrochloric acid. After the absorption has terminated, withdraw the ball of chloride and replace it by a ball of potash to remove the vapours of hydrochloric acid given off by the acid chloride. If the mixture which contains carbonic oxide also contains oxygen, the latter gas is determined first by pyrogallic acid and potash. The estimation of the hydrogen and carburetted hydrogen is then effected eudiometrically as in No. 3.

X. Coal Gas.

HS CO_2 CO C_4H_4 C_2H_4 H N

The mixture is first accurately measured in a graduated tube standing over mercury. The hydrosulphuric acid is then estimated by means of a ball of binoxide of manganese impregnated with phosphoric acid.

After removing the binoxide of manganese and measuring the remaining volume, introduce a ball of caustic potash, which absorbs carbonic acid.

The carbonic oxide is determined by means of acid subchloride of copper.

To determine the bicarburetted hydrogen introduce into the residue a fragment of coke soaked in a concentrated solution of anhydrous sulphuric acid in monohydrated sulphuric acid. The absorption of the bicarburet takes place very rapidly; the coke is then withdrawn and the acid vapours absorbed by potash.

The estimation of the hydrogen and proto-carburetted hydrogen is then performed as at No. 3. The nitrogen remains as a residue.

The bicarburetted hydrogen, as well as the protocarburet and the hydrogen, may also be estimated by the eudiometer. To effect this pass the mixture of these three gases and the nitrogen into the eudiometer with three times its volume of oxygen, and pass the spark. The free hydrogen, as well as that of the carburets, combine with oxygen to form water, whilst the carbon becomes carbonic acid. Then pass the residue of the combustion into a graduated tube, and estimate the carbonic acid with potash, and the excess of oxygen with potash and pyrogallic acid. The residue left after this double absorption gives the nitrogen.

The volumes of bicarburetted hydrogen, protocarburetted hydrogen, and hydrogen may then be obtained by a simple calculation. The reactions which take place may be represented by the formulæ

$$\underbrace{H}_{2\text{ vols,}} + \underbrace{O}_{1\text{ vol.}} = HO$$

$$\underbrace{C_2H_4}_{4\text{ vols.}} + \underbrace{8O}_{8\text{ vols.}} = 4HO + \underbrace{2CO_2}_{4\text{ vols.}}$$

$$\underbrace{C_4H_4}_{4\text{ vols.}} + \underbrace{12O}_{12\text{ vols.}} = 4HO + \underbrace{4CO_2}_{8\text{ vols.}}$$

These equations show us:—1. That the combustion of bicarburetted hydrogen requires thrice its volume of oxygen, that of bicarburetted hydrogen double its volume, and that of hydrogen half only. 2. That the bicarburet produces double its volume of carbonic acid, and the protocarburet its own volume exactly.

Therefore, calling x, y, z the volumes of the bicarburet, the protocarburet, and the free hydrogen, of which the sum is known and represented by c, we have—

$$3x + 2y + \frac{z}{2} = a$$

$$2x + y = b$$

$$x + y + z = c$$

a and b are the volumes of oxygen employed, and of the carbonic acid produced, volumes of which have been determined by experiment.

To find the values of x, y, and z, subtracting the first equation from the sum of the two others, we find—

$$\frac{z}{2} = c + b - a, \text{ whence } z = 2(b + c - a),$$

Then subtracting the last from the second we find—

$$x - 2(b + c - a) = b - c, \text{ whence } x = 3b + c - 2a,$$

The second equation then gives—

$$y = 4a - 5b - 2c.$$

ON THE ACTION OF LIGHT ON CHLORIDE OF SILVER.

By M. MORREN, Dean of the University of Sciences of Marseilles.

Take a glass tube 3 centimetres in diameter, and from 45 to 50 centimetres in length, close one end and introduce two bulbs, one containing nitrate of silver, the other chloride of potassium, in equal equivalents; fill the tube with a concentrated solution of chlorine in water, then carefully seal it before the blowpipe. Break the bulbs by agitation, when the result will be chloride of silver deposited in an excess of chlorine water. If the tube be exposed for several days to the rays of the sun, the following facts may be observed. 1st. As long as the liquid preserves the yellow colour given to it by the chlorine, the chloride of silver remains white. 2nd. When this yellow colour disappears by the action of the chlorine on the water under the influence of light, the chloride of silver slowly assumes, not the very deep violet which we see in the reactions of photography, but a red brown, which at first only appears gradually and on the surface, but in time penetrates the entire white mass, provided the tube is sufficiently agitated, and submitted to the action of a bright sun. 3rd. The tube being placed, if not in obscurity, at least in the diffused light of the laboratory, the brown colour disappears gradually, and the chloride of silver reassumes, in all its intensity, its original white aspect. Replace the tube in the sunlight, and the colouration takes place afresh, to disappear again when the tube is returned to the shade, and so on indefinitely. The interesting questions involved in these successive evolutions have occupied me much, and I intend to devote still more attention to them.

ON THE ARTIFICIAL PRODUCTION OF BENZOIC ACID FROM NAPHTHALIN.*

By Dr. ADOLF OTT.

Benzoic acid is a crystallizable, soft, white body, inodorous when pure, but smelling like gum benzoin when gently warmed; it usually has a faint aromatic odour, sweetish taste, but produces a burning sensation in the throat. Litmus is feebly reddened by it; it fuses at 250° Fahr., sublimes at 300° Fahr., and boils at 462° Fahr., yielding a vapour of the sp. gr. 4·27. It exists in benzoin, in the tolu balsam, in the gum of *Xanthorræa hastilis*, in castor, and has also been met with in the urine of man and herbivorous animals, &c. Benzoic acid is also found by the oxidation and decomposition of oil of bitter almonds, protochloride of benzoil, hippuric acid, &c., and further by the action of a solution of caustic baryta on populin and other organic compounds. It has hitherto, nevertheless, only been prepared from the gum benzoin, either by subliming the same—a process existing since 1703 (*vide* Turquet de Mayerne, "Pharmacopœa in Oper. medio." London)—or by a process, due to Wœhler, which we will here not further describe, as it can be found in nearly any larger hand-book of chemistry. We only will mention that it is used in medicine to some extent, viz., against affections of the throat; largely in the manufacture of aniline blue; and for the preparation of tobacco sauces.

This interesting substance, of which the chemical formula is $C_{14}H_6O_4$, has now lately been produced, at a rate allowing the manufacturer large profits, from a substance which, in its crude state, can be got for less than one cent a pound. In the following I will proceed to describe the process, but first mention something about naphthalin:—

This hydrocarbon (formula $C_{20}H_8$) was discovered in 1820, by Garden, in the coal-tar of the gas works, and studied by Liebig, Faraday, Wœhler, and others. It is a colourless, inflammable solid, of a burning aromatic taste, and peculiar smell. Its specific weight is 1·048, its melting point 175°, and its boiling point 428° Fahr. It sublimes unaltered in laminæ, and can also be obtained in rhomboidal crystals from its alcoholic solution. It is inflammable, and burns with a very smoky flame. Its derivates have principally been studied by the celebrated Laurent.

The process now by which this hydrocarbon is transformed into benzoic acid is the following:—

(1.) *By the Process of Laurent.*—The naphthalin is transformed into the α modification of the bi-proto-chloride of naphthalin, $C_{20}\,H_8\,2Cl_2$.

(2.) The bi-protochloride of naphthalin is converted by oxidation into phtalic acid, $C_{16}\,H_4\,O_6\,2HO$, and the latter into phtalate of ammonia, $C_{16}\,H_4\,O_6\,2NH_3$.

* A paper read before the Polytechnic Association of the American Institute.

(3.) We obtain then the phtalamid, $C_{16}H_5NO_4$, simply by subjecting the phtalate of ammonia to distillation.

(4.) By distilling the product obtained by process 3 with hydrate of lime, benzonitril, $C_{14}H_5N$, is formed.

$$C_{16}H_5NO_4 + 2CaO = C_{14}H_5N + 2CaO, CO_2.$$

(5.) In boiling the latter with a solution of caustic soda, benzoate of soda is formed, from which benzoic acid is precipitated by hydrochloric acid.

This is, in short, the process as followed by John Castelhay, of Paris, and of which Menier, the Secretary of Class 44 of the International Exhibition in Paris, says that it is the most important discovery made in technical chemistry since the London Exhibition of 1862.

CARBOLIC OR PHENIC ACID AND ITS PROPERTIES.*

By Dr. F. CRACE CALVERT, F.R.S. &c.

Gentlemen,—I have readily accepted the friendly invitation of your illustrious president, M. Dumas, to submit to your notice some facts relative to carbolic acid. But before doing so, allow me to express publicly the feelings of gratitude which I owe to France for having opened to me the way to the profession which I pursue with such pleasure. In truth, it is to the sympathy of scientific men of this country, to the friendly assistance of one of your scientific celebrities, M. Chevreul, and to the liberality of your institutions, that I owe the knowledge I have acquired, the elements of which I gained at the Gobelins and at the Museum of Natural History, during the stay I made there. After these remarks I will proceed with the subject of my lecture.

No doubt most persons present are aware that when coals are submitted to the action of a dull red heat, in a retort, products are obtained which may be grouped into four classes.

1. Gaseous products, commonly called coal gas, and which are now employed in so general a manner as means of illumination, sources of heat, and motive power.

2. Water, containing ammonia and ammoniacal salts, substances which chemistry purifies, modifies, and which are then utilised in agriculture, manufactures, and medicine.

3. There distils with the above products a black, sticky substance, of an unpleasant odour, called tar.

4. There remains in the retort a solid, porous body, which is known to us all as coke.

When the above-mentioned product called tar is submitted to distillation, water first comes over, then there distil jointly with this fluid liquid carburetted hydrogens, which, being lighter, float on it and are therefore called light oils of tar; and, lastly, compounds heavier than water are collected, which bear the name of heavy oils.

It is these heavy oils which were the first tar products utilised in manufacture. Their consumption made such rapid progress in England, that special manufactories were established for their preparation, and these works were, for a long period, the only ones in which tar products were produced. Most of them were established between 1837 and 1847, for the production chiefly of coal naphtha, used for many purposes, and heavy oils, employed for the preservation of railway sleepers, by a process discovered by Mr. John Bethell, by means of which they are preserved twelve or fifteen years; whilst without it they decay after three or four years. I have much pleasure whilst on this subject, in calling your attention to a very remarkable and very complete work upon the creosoting of wood, by M. Forestier, chief engineer of the department of La Vendée, assisted by M. Marin. These gentlemen have made numerous experiments, the result of which is that wood thus treated is preserved from decay in water as well as under ground, and, what is important, wood is no longer destroyed by that very destructive insect the *teredo*.

Lastly, there remains in the still (after the heavy oils and some semi-solid substances have distilled off) a product which is fluid at the high temperature at which this operation is conducted, but which, when exposed to the natural temperature of the atmosphere, becomes hard and brittle, and is known under the name of pitch. This product, as you are aware, is largely employed in Paris under the name of asphalte, bitumen, &c., to make the foot pavements and public walks, as well as for the manufacture of a sort of concrete, called in England patent fuel.

After this rapid sketch of the products given off during the distillation of coal and tar, allow me to call your attention to *carbolic* or *phenic acid*, also called carbolic or phenic *alcohol*; in fact the latter is the most appropriate name for this substance, as its properties are not those of an acid, but that of an alcohol.

It is now twenty years since Laurent, the eminent chemist, first pointed out an easy method of extracting carbolic acid from coal tar. It consisted in submitting the light oils to a fractional distillation, and then treating with a concentrated solution of potash those products which had distilled at a temperature between 160° and 200°, separating the alkaline solution from the hydrocarbons which floated on it, and then neutralising the alkali by an acid which liberated the carbolic acid.

Such was Laurent's method of preparing carbolic or phenic acid, but pure carbolic acid was only there in a very small proportion; it was, in fact, a mixture composed chiefly of different liquids similar in properties and composition to carbolic acid, and, though Laurent succeeded in obtaining solid carbolic acid, still the process devised by him was too expensive to answer on a manufacturing scale; and, besides, his method of operating was too complicated.

In 1847, Mansfield, and towards 1856, M. Bobœuf, made known processes which, in fact, were only a modification of Laurent's, for they consisted principally in employing caustic soda instead of potash, and in treating the whole of the light oils instead of a special portion of them, as Laurent had done; still, by these processes, a very impure acid was obtained, from which it was very difficult, as experience has shown us, to extract pure carbolic acid; however, in a commercial point of view, the process of these gentlemen was a step in the right direction. This method was followed by Mr. Clifts in manufacturing some carbolic acid for me about the year 1847; and it was this impure acid which was employed by several chemists who, like myself, studied the properties of this substance, and who were endeavouring to apply it usefully; and I succeeded at about that time in applying it to the production of picric acid, or in preventing the transformation of tannic acid into gallic acid, in tanning substances, or, finally, in the preservation of subjects for the dissecting-room. M. Bobœuf also made use of it in preserving organic bodies from putrefaction, a property which has received of late very important applications.

In 1859, M. Marnas, of the firm of Guinon, Marnas, and Bonnet, of Lyons, came to Manchester, and asked me to furnish him with a purer carbolic acid than had been as yet manufactured. He showed me a white and crystalline product, which he gave as a specimen. It was then necessary to make new experiments, and we (F. C. Calvert and Co.) discovered that the best mode of preparation was not by treating light or heavy oils of tar with concentrated alkalies, but, on the contrary, by treating the impure benzines of commerce or naphthas with weak alkaline solutions. By this means a semi-fluid, blackish product was obtained, a little heavier than water, of a density of 1·06, and which contained 50 per cent of real carbolic acid, which acid we managed to separate in part by careful

* Lecture before the Society for the Encouragement of National Industry in France.

distillation; and it was this product which was employed by Messrs. Guinon, Marnas, and Bonnet, and others, till 1861, for the manufacture of colours derived from carbolic acid. At this period the colours obtained from aniline were so fine and brilliant that, to keep up a comparison with them, it was necessary to improve those derived from carbolic acid. To effect this it was necessary to improve the quality of the carbolic acid then manufactured, and, after some trials, we produced carbolic acid in white detached crystals, melting at between 26° and 27°; and this is the product which is now generally employed in commerce and industry, as witness the specimens which are to be seen at the present Universal Exhibition. In 1863 this relative purity was insufficient, and the same firm which had required the improvements which I have before named asked us to try and make it still purer. We again set to work, and produced commercially Laurent's phenic alcohol or carbolic acid; that is to say, a substance melting at 34°C., and boiling exactly at 186°. This became a very important commercial product for us, and we delivered large quantities monthly.

From this time I made many efforts to draw the attention of the medical profession to the really remarkable therapeutic properties of carbolic acid, but the tarry and sulphuretted odour which it still possessed was a serious obstacle to its application. I soon succeeded in overcoming this difficulty, and towards the end of the year 1864 our firm was in a position to deliver, in considerable quantities, carbolic acid deprived of sulphuretted compounds, and therefore fit for all medicinal uses. But I am glad to say that the series of improvements in the manufacture of pure carbolic acid, or phenic alcohol, did not stop there, for towards the end of last year I discovered a process which now enables me to show you a product completely deprived of all disagreeable odour and tarry flavour, and, in fact, as pure, though extracted from tar, as if it had been produced artificially by the help of the reactions recently discovered by Messrs. Wurtz and Kékulé, based upon the direct transformation of benzine into carbolic acid, or by the well-known changes by which it may be obtained from salicylic acid or nitro-benzoic. This new phenic or carbolic acid is distinguished from Laurent's in being soluble in 20 parts of water, whereas the latter requires 33. It is fusible at 41°, instead of 34°, and boils at 182°, instead of 186°, but it gives, like Laurent's, the blue colour described by M. Berthelot when mixed with ammonia, and to the solution is added a small quantity of a hypochlorite; the same effect is also produced when you expose to the vapours of hydrochloric acid a chip of deal soaked in this pure carbolic acid.

It was supposed that, as Laurent's phenic acid had a constant boiling and crystallisation point, it was a pure and definite substance. Now, the production of our new acid shows it is nothing of the kind, the product of Laurent being only a combination of our pure carbolic acid and a liquid homologue; for when to the acid of Laurent is added a certain proportion of water, and the mixture is exposed to a temperature of 4° C., it deposits a crystalline substance in large octahedrons; which is a hydrate of carbolic or phenic alcohol, that is to say, carbolic acid combined with an equivalent of water of crystallisation. This fact is important in a chemico-theoretical point of view, for it exhibits the only example known of an alcohol which, combining with water, forms a crystallised hydrate. By removing from this hydrate the equivalent of water which it contains, carbolic or phenic acid is obtained in its purest state.

(To be continued.)

Faraday as a Discoverer.—Under this title Messrs. Longman and Co. announce a memoir of the late Professor Faraday, by Dr. Tyndall. It is to be in one volume, crown, 8vo, and will be published in January.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

December 5th, 1867.

Dr. Warren de la Rue, F.R.S. President, in the Chair.

The minutes of the previous meeting were read and confirmed, the donations to the library announced, and the notice convening a special or general meeting of members for the consideration of a proposed alteration of the first by-law was again read. The President explained the nature of the amendments which it was contemplated to make, and, after taking the vote by show of hands, declared them to have been unanimously agreed to. By a second resolution it was decided that they should take effect from the first meeting in the new year, The by-law as amended stands thus:—

"Every candidate for admission into the Society shall be proposed according to a form of recommendation (No. I., Appendix) subscribed by five Fellows of the Society, to three, at least, of whom he should be personally known, and such certificate shall be read and suspended in the Society's rooms, or place of meeting, for three ordinary meetings."

A verbal modification in the heading of the form of recommendation was likewise acceded to.

The Secretary then read for the first time the names of the following candidates for admission into the Society, viz., Captain Alexander Walker, Royal Artillery, Bengal Presidency; Gilbert W. Child, M.D., St. Giles, Oxford; Mr. Edward Chapman, Lecturer in Natural Science at Merton College, Oxford (Frewen Hall, Oxford); W. G. Mason, Eserick, near York; and Peter Greiss, Burton-on-Trent.

For the second time were read the names of Alfred E. Fletcher, Inspector of Alkali Works, Johnston, near Prescot; and William Frank Smith, M.D., Lond., Lecturer at the Sheffield School of Medicine, Glossop Road, Sheffield.

The names of the undermentioned candidates were read for the third time, and from the results of the ballot all were declared to have been duly elected, viz., Thomas Hall, B.A., Lond., Lecturer on Chemistry and Natural Philosophy at the City of London School; Charles Walter Maybury, Teacher of Chemistry, 90, King Street, Manchester; George Lunge, Ph.D. (Breslau), 10, Albert Terrace, South Shields; Facundo J. R. Carulla, Chemist to the Atlas Steel and Iron Works, 59, Gell Street, Sheffield; Charles Meymott Tidy, M.B., The Hollies, Cambridge Heath, Hackney; Augustus A. Wood, Cheapside; Alfred Coleman, Plough Court, Lombard Street; Walter W. Fiddes, Sothernhay, Clifton; Robert R. Tatlock, Kyles of Bute; Phipson Beale, Barrister-at-law, Stone Buildings; and Alexander Crum Brown, M.D., D.Sc., 4, Rillbank Terrace, Edinburgh.

Mr. W. H. Perkin read a paper "*On the Artificial Production of Coumarine, and Formation of its Homologues.*" Referring to the hydride of aceto-salicyl as a body isomeric with coumaric acid, and to his failure in obtaining this body by the method of Cahours, the author attempted its preparation by the action of acetic anhydride upon the hydride of sodium-salicyl, thus,

$$\left(\begin{matrix}\mathrm{COH}\\ \mathrm{C_6H_4}\\ \mathrm{Na}\end{matrix}\right\}\mathrm{O}\Big) + \left.\begin{matrix}\mathrm{Ac}\\ \mathrm{Ac}\end{matrix}\right\}\mathrm{O} = \left(\begin{matrix}\mathrm{COH}\\ \mathrm{C_6H_4}\\ \mathrm{Ac}\end{matrix}\right\}\mathrm{O}\Big) + \left.\begin{matrix}\mathrm{Na}\\ \mathrm{Ac}\end{matrix}\right\}\mathrm{O}.$$

Instead, however, of getting at once the expected product, a substance was obtained which differed from it by

containing $C_9H_6O_2$, *i.e.*, deficient by the elements of one atom of water. This formula coincides with that of coumarine, with which, indeed, it proves to be absolutely identical. Its odour resembles that of the Tonquin bean, and the fusion and boiling-points are the same. The author has exactly determined the physical characters of coumarine, both from natural and artificial sources, and calls in question the accuracy of some of the recorded observations.

By employing the anhydrides of other acid-radicals, Mr. Perkin obtains a series of homologous coumarines, which are fully described in the paper; particularly, he has formed a crystalline butyric coumarine, $C_{11}H_{10}O_2$, fusing at 72—73°C., and submitted it to the action of alkalies, bromine, &c. The valeric coumarine was likewise prepared, and an ingenious method of purification resorted to for the purpose of procuring a sample fit for analysis. Its formula is $C_{12}H_{12}O_2$, and fusion point 56°C.

The author concludes his paper with a survey of the probable constitution of this class of bodies, and conceives that the reaction quoted above actually expresses the *first stage* of the interchange involved in the production of the coumarines, since by very careful working he procured in one instance some of the hydride of acetosalicyl which he found to possess the properties both of an aldehyde and acetate; but he promises to give shortly a fuller account of this substance.

In proposing a vote of thanks to Mr. Perkin, reference was made, both by the President and by Dr. A. W. Hofmann, to the original research conducted in the laboratory of the Royal Chemistry by Dr. Bleibtreu, who, in 1846, established the identity of coumarine of the Tonquin bean with the aromatic principle contained in the German "Maiwein," which is prepared from the little forest plant known as woodruff (asperula odorata).

Professor A. H. Church then made a statement respecting the nature of the red (or crimson) colouring matter which is commonly found on the primary and secondary pinion feathers of the wings of the Cape Lory (*Turacus albocristatus*). The author's attention was called to this matter by the editor of the *Field* newspaper, and he had since had opportunities of studying the habits and experimenting upon the feathers of some little birds reared in this country by a celebrated ornithologist. They were popularly supposed to be stained with blood, since it has been noticed that some of the colour is washed out by the rain. The colouring matter is, however, only very slightly soluble in pure water; but if a trace of alkali be added, it then freely dissolves out, forming a magnificent crimson solution. Hydrochloric or other mineral acid added to this liquid at once precipitates the red substance [Experiment shown]. The remarkable feature of the whole case was the fact that analysis proved the existence of copper, apparently in some organic form of combination. [This important observation was exhibited at the meeting by showing with the aid of a platinum wire the bright green tinge imparted to a gas jet when a small quantity of the substance, moistened with hydrochloric acid, was held in the flame of a Bunsen burner.] The web of the feather and parts not coloured did not contain a trace of copper, and only sixteen feathers in all showed this peculiar phenomenon. The total amount of colouring matter was therefore very small, only 1·6 grains being procurable from each bird at the cost of half a guinea. The author's experiments were, for the present, interrupted for want of material; but he was satisfied that the organic body in combination with the copper contained nitrogen, with carbon, of course, and, he believed, sulphur. The substance may be dissolved in concentrated sulphuric acid, and reprecipitated unaltered upon the addition of water. None of the copper is thus separated; but if nitric acid be used the organic elements are destroyed, and then copper may be detected even in the diluted solution. [A bird and several plumes were exhibited, besides a small quantity of the colouring matter in a separate form.]

The President remarked upon the singular character and mode of occurrence of Mr. Church's new substance. For his own part he was not aware of the existence of any crimson dye containing copper.

In answer to Dr. Gladstone, the author stated that he had made an optical examination of the substance, and compared its absorption spectrum with that of arterial blood. There was a general similarity so far as regards the fact of their both showing two bands; but in the present instance they were nearer to the yellow end of the spectrum, and the darker band almost coincided with the fixed line D. Professor Church further stated that he failed in detecting copper in the red plumage of humming birds.

A "*Note on the Preparation of Urea*," by Mr. John Williams, was next read. The author proceeds, in the first instance, to prepare cyanate of potassium by fusion of the cyanide (best commercial quality, containing 90 per cent) with red oxide of lead, keeping the temperature as low as possible. This product is dissolved in cold water, mixed with nitrate of barium to precipitate the carbonate which it usually contains, then thrown down as lead-salt by adding a solution of the nitrate. The cyanate of lead is easily purified by washing, and is then dried at a gentle heat. For the preparation of artificial urea equivalent amounts of sulphate of ammonia and cyanate of lead are digested together in warm water, the insoluble sulphate filtered off, and the solution when evaporated yields a product of unusually good quality, and of larger amount than by the ordinary plan. Mr. Williams finds that the process is applicable to the preparation of the compound-ureas, using the corresponding sulphate instead of the simple ammonia-salt.

Dr. A. W. Hofmann, who was welcomed in a most enthusiastic manner, then gave an account of his recent discovery of the "methylic aldehyde," and, with Mr. M'Leod's assistance, performed an experiment by means of which the method of production of this interesting compound was conclusively demonstrated. The main facts of Dr. Hofmann's research have been already communicated to our readers in an article specially devoted to their consideration last week, and it is now only necessary to report the latest statements of the eminent author regarding its constitution.

Dr. Hofmann remarked that "a more minute examination of methylic aldehyde and its derivatives remains still to be made. It will be absolutely necessary to isolate the oxygen term, and to determine its vapour density, in order to ascertain its molecular weight. If we remember the facility with which the aldehydes are polymerised, the question presents itself whether the aldehyde formed by the slow combustion of methylic alcohol is represented by the formula—

$$CH_2O,$$

or a multiple thereof. A similar remark applies to the sulphur derivative. It deserves, moreover, to be mentioned that a compound isomeric with methylic aldehyde, the dioxy-methylene ($C_2H_4O_2$) of Boutlerow, is known already; also that a sulphur compound of the formula—

$$CH_2S$$

has been obtained by M. Aimé Girard, who observed that bisulphide of carbon is reduced by the action of nascent hydrogen with disengagement of sulphuretted hydrogen."

Dr. Hofmann then proceeded to describe the leading features of another research, which will be printed *in extenso* in our columns, and which has resulted in the production of "*A New Series of Bodies Homologous to Hydrocyanic Acid*." The action of alcoholic ammonia upon chloroform, in the presence of a fixed alkali, was shown experimentally to give rise to the formation of a cyanide (afterwards indicated by the Prussian blue test); and in like manner a mixture of aniline, chloroform, and alcoholic potash furnished an aromatic oil of powerful cyanic odour which the author believes to be the cyanide of phenyl

$$C_7H_5N.$$

This compound differs in every respect from Fehling's benzonitrile, with which it is isomeric. A great number of similar reactions were indicated by the speaker, and a general principle enunciated which will take a long time fully to exhaust. Already the author has made good progress towards examining the action of chloroform upon the diamines.

Professor ABEL, who at this stage of the proceedings occupied the chair, said that at so late an hour it would be impossible to enter upon a discussion of Dr. Hofmann's interesting results. He would, however, invite the members to give expression to the formal proposal which he had now the pleasure of moving. [The vote of thanks was received with loud acclamation.]

Dr. HOFMANN, in acknowledging the kind welcome with which he had been received, testified to the pleasure he felt in the circumstance that a meeting of the Chemical Society happened to coincide with the period of his short visit to London. He was delighted to meet at once so many friends, and could assure them that he felt so greatly the want of similar encouragement in Berlin that within the last few weeks he and his colleagues had inaugurated a Chemical Society in the Prussian capital, founded on the model of the parent Society in London—(Applause).

The SECRETARY announced the title of a paper to be read at the next meeting, 19th instant, viz:—"*Analogies in the Cooling of Water and Bismuth*," by Mr. Alfred Tribe. The meeting in January (16th proximo) would be devoted to a lecture "*On Water Analysis*," by Dr. E. Frankland; and Mr. Siemens had promised to give a lecture, of which the date was not yet fixed, "*On the Production of Steel direct from the Ore.*"

The meeting, at which there was a very full attendance, both of Fellows and visitors, was then adjourned.

PHARMACEUTICAL SOCIETY.

Wednesday, December 4, 1867.

T. H. HILLS, Esq., Vice-President, in the Chair.

AFTER the minutes of the preceding meeting had been read and confirmed, and the thanks of the meeting given for several donations to the library and museum,

Dr. ATTFIELD referred to the paper in the November number of the *Pharmaceutical Journal*, "*On a New Kind of Kamala*," which was obliged to stand over from their last meeting. Since then he had seen Prof. Anderson, the discoverer of rottlerine, and had referred to the great difference between the amount of impurity he had found in the samples he had examined and that of Foibourg, who had found about 28 per cent of impurity, while the only impurity Anderson had found was 3½ per cent of ash. Dr. Anderson had worked upon a sample collected for him with great care by Dr. Cleghorn, while it was possible that Foibourg had worked upon a very impure article.

Mr. D. HANBURY, F.R.S., thought the explanation of Dr. Anderson scarcely satisfactory. He had written to Dr. Anderson asking him for a specimen of the kamala, for he thought Anderson might have been working on the new kind; but on examination he found it to be the old kind. Foibourg had tried every possible way, and he found it was not highly crystalline, and only in small quantities.

Dr. ATTFIELD said that Dr. Anderson had found vegetable as well as mineral impurities.

Mr. HANBURY had found no vegetable substances, excepting remnants of the capsule, or portions of the leaf. The impurities were ferruginous earth and siliceous particles.

Mr. HOWDEN then read an interesting paper "*On the Norwegian (Lofoden) Cod Fisheries.*" The author commenced by referring to the codfish migrating at certain periods of the year, which he thought was due to the instinct of propagation. He then described the way in which the fish were caught, and the livers preserved till the oil could be separated, giving full particulars respecting the different modes adopted by the fishermen and others.

Mr. HOWDEN also exhibited four samples of oil, the finest being the genuine Lofoden oil imported by Mr. Moller, and the fourth sample a very dark brown oil with a strong disagreeable odour. The livers from which this sample was obtained had been boiled over an open fire for 12 hours, showing the pernicious influence of a strong heat in the separation of the oil.

The CHAIRMAN thanked Mr. Howden for the valuable paper, and referred to the oil obtained in England. He knew some very fine oil was obtained, and in considerable quantities, from livers weighing 1lb. and 2lbs. each.

A MEMBER enquired how it was that the Norwegian Phamacopœia allowed the use of several species.

Mr. HOWDEN said that at the present time a new edition of the Norwegian Pharmacopœia was being prepared, which would be similar to the British Pharmacopœia.

Mr. INCE alluded to the various statements which have been made with reference to the cod fisheries. No two authors were at all agreed. He thought the paper read by Mr. Howden very valuable, as it gave the opinions of gentlemen direct from the spot. He then referred to the geographical position of Lofoden, and the different ways of spelling the word Lofoden. Only a few days since he was reading two pamphlets, both written by persons from the spot, and yet there was a great difference between them; and there had, he believed, been four different articles in the *Pharmaceutical Journal* all expressing different opinions.

Professor REDWOOD, in thanking Mr. Howden for his very practical paper, said he believed there were great advantages attaching to the preparation of the oil in Norway, arising from the fact that they had greater facilities for obtaining the livers fresh and exposing them to a low temperature for the separation of the stearine from the oleine; but in England we could obtain very good oil, its intrinsic qualities being equal to Newfoundland oil. Moller's oil was of excellent quality; but there were different opinions as to which of the three kinds of oil were therapeutically the best. On exposure to the air it absorbed oxygen, and the difference between the light and the dark showed the degree of oxidation which had taken place. It probably undergoes a process of oxidation in the system, for persons in the habit of taking cod-liver oil often acquire an odour which the pure oil possesses after long exposure to the air.

Mr. H. B. BRADY had prepared a paper entitled "*Supplementary Remarks on the Preparation of Medicated Pessaries and Suppositories*;" but as the time had expired, he postponed the reading of the paper, and only made a few observations on some specimens of moulds and suppositories, &c., which he had laid on the table. In speaking of pessaries, Mr. Brady said there was an objection to their being too large. He thought one dram would be found a much better size than two drams.

The CHAIRMAN stated that as the 1st of January would be the first Wednesday in the month there would be no Pharmaceutical meeting till the 5th of February. He concluded by wishing them all a merry Christmas and a prosperous New Year.

A Well-deserved Honour.—The "International Societies for Aid to the Wounded in Time of War" have awarded to Mr. Condy, of Battersea, their medal, in recognition of the importance to military surgery of his discovery of the disinfecting properties of the alkaline permanganates, and the great sanitary value of Condy's fluid, as proved by the experience of the Prussian army surgeons during the late Bohemian war.—*Lancet.*

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

PHYSICAL AND MATHEMATICAL SECTION.

November 7th, 1867.

ROBERT WORTHINGTON, F.R.A.S., President of the Section in the Chair.

"*Note on the Colour of the Moon during Eclipses*," by A. BROTHERS, F.R.A.S., &c.

On the night of October 4th, 1865, there was a partial eclipse of the moon, when about one-third of the disc was obscured. My time and attention on this occasion were chiefly directed to some photographic experiments, and it will be remembered I then obtained pictures of the eclipse at short intervals, from the commencement to the end. At about the greatest phase I looked at the moon through the telescope with an eye-piece of low power, for the purpose of noticing whether the eclipsed portion showed colour, and at once saw that the part of the moon most deeply within the shadow was of a decided copper colour, such as I had seen some years previously during a total eclipse of the moon.

The eclipse which occurred on the night of the 13th September last, was rather more favourable for detecting the presence of colour, as seven-tenths of the moon were covered by the earth's shadow; the weather being clear many persons have recorded their observations, and as the colour of the moon is one of the chief features of a lunar eclipse, this point attracted considerable attention.

Mr. Browning says, in a letter which appeared in the "Astronomical Register"—"I looked most carefully for colour both with the 10½ silvered glass reflector furnished with an achromatic eye-piece of very low power, and also with a five-feet refractor; with neither could I detect a trace."

Mr. Slack, who was also observing with a silvered glass reflector, and in the same locality as Mr. Browning, says, —"After twelve, the eclipsed limb grew noticeably redder, the red coppery tint chiefly affected the lower parts of the obscured limb, but was visible further in, gradually blending with the inky tints presented by the umbra at its advancing edge."—(*Int. Obs.*, October.)

Mr. Weston, observing at Landsdown, near Bath, says, —"The prevailing colours were red-bluish and grey, *and grey*: the redness increased towards the darkened edge of the moon."—(*Monthly Not.*, 9, xxvii.)

Many other observers speak of the presence of colour, but on the other hand a few say they did not notice any, the eclipsed portion of the moon merely having a darkened appearance.

On this occasion I did not make any photographs, as I could not expect results materially differing from the last, and I gave my whole attention to observing the progress of the eclipse through the telescope, which is a refractor of five inches aperture. As to the question of the presence of colour, I can most distinctly say that *colour* gave the moon a very beautiful appearance, and it seemed to me the most interesting feature of the eclipse. The beauty of the moon's surface appeared to increase as the penumbral shadows stole over its surface; and until the shadow itself was considerably advanced, all the details of the lunar surface could be distinctly made out, and during the whole period of the eclipse some of the brighter points of light within the shadow continued visible, as did also the entire disc with many of the details of light and shade. The colour of the eclipsed limb was of a coppery hue, much brighter towards the part most deeply within the shadow. The part of the moon not eclipsed was of a beautiful bluish-grey colour.

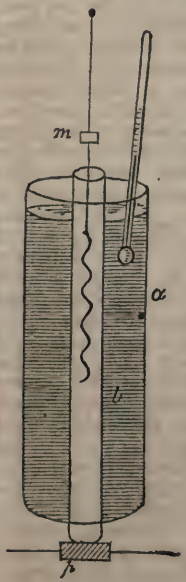
That the appearance of colour cannot be caused by the telescope or by peculiarities in the eyes of the observers is, I think, proved by the fact, that the same colours are seen whether refractors or reflectors, either of metal or silvered glass, be used; and, as the majority of observers see colour, the eyes of those who remark the absence of it are perhaps temporarily afflicted with colour blindness; —the bright light from the uneclipsed portion of the moon may be sufficient to produce this in some persons. If an observer, after looking at the moon through the telescope, attempts to look at objects while the other eye remains closed, it will be found that until the retina has recovered from the excess of light every thing will appear misty—in fact, the eye is partially blinded, and it may be that some eyes are sufficiently sensitive to be affected by the diminished lustre of the moon, and may thus be prevented seeing colour, which there can be no doubt the lunar surface presents during an eclipse.

Some observers have remarked on the difficulty of detecting the first appearance of the shadow, and although the exact time is known, the real shadow is not seen until many seconds or perhaps minutes after the predicted time. In the present instance, I watched very carefully for the first appearance of the shadow, and, having previously ascertained the error of my watch, I took my position at the telescope, at the same time I requested a friend to take particular notice of the time at the moment I saw the shadow. The result thus obtained was within twenty seconds of the time given in the "Nautical Almanac," clearly showing that under favourable conditions, and, if the attention be given carefully to the subject, the real shadow may be detected very near the predicted time.

Ordinary Meeting, November 26th, 1867,

EDWARD SCHUNCK, F.R.S., &c., President, In the Chair.

"*On a Thermometer unaffected by Radiation*," by DR. J. P. JOULE, F.R.S., &c.



In the annexed figure *a* is a copper tube about one foot long, and has a tube open at both ends in the centre. Water is poured into the space between the two tubes. In the centre tube there is a spiral of fine wire suspended by a filament of silk, and having a mirror at *m*. There is a lid at *p* which can be removed at pleasure from the lower end of the tube. When *p* is situated as in the figure, there can be no draught, and consequently the spiral with its mirror is at zero of the scale. But when *p* is removed, there is a current of air which turns the spiral, if the air in the tube has a different temperature from that of the outside atmosphere. In my apparatus, one degree F. produces an entire twist of the filament. I find that the temperature in the tube is generally warmer than in the outside atmosphere of a room, which must be owing to the conversion of light and other radiations into heat on coming into contact with the copper tube. I have tried the apparatus in the open air on a still day, with the same result. Of course when there is wind the effect is masked, but I feel confident that by increasing the length of the tube, making it 30 feet for instance, and using certain precautions, this difficulty may be overcome.

NOTICES OF BOOKS.

Micro-Chemistry of Poisons, including their Physiological, Pathological and Legal Relations: Adapted to the use of the Medical Jurist, Physician, and General Chemist. By Theo. G. Wormley, M.D., Professor of Chemistry and Toxicology in Starling Medical College, and of Natural Sciences in Capital University, Columbus, Ohio. With Seventy-eight Illustrations upon Steel. New York: 1867. Baillière Bros.

The chief objects of Professor Wormley's book are stated by the author to be "to indicate the limit of the reactions of the different tests which have heretofore been proposed, as also of those now added, for the detection of the principal poisons, and to point out the fallacies attending the reaction of each; and, also, to apply the microscope, whenever practicable, in determining the nature of the different precipitates, sublimates, &c., and to illustrate these, whenever of practical utility, by drawings."

The plan of the book is therefore peculiar. It does not affect to be a complete treatise on toxicology, for the poisons described are few in number and are principally those which can be readily detected by chemical methods. The list is indeed so circumscribed that we look in vain for many highly important poisons. There is no mention of colchicum, cantharides, or croton oil: the poisonous gases are entirely omitted, and this is even the case with some substances, such as nitrobenzol,* cocculus indicus and the salts of barium, which can be detected by purely chemical methods. We cannot but regard these omissions as an abridgement of the utility of a work which is evidently intended rather for the professional man than the student.

Within its own limits, however, the book is excellent, and we fully admit that for common purposes the limits are quite wide enough. It is divided into two parts, the first devoted to inorganic, and the second to vegetable, poisons. The first part includes the alkalies, the mineral acids, oxalic and hydrocyanic acids (placed here for convenience), phosphorus, antimony, arsenic, mercury, lead, copper, and zinc. The second part is entirely confined to the poisonous alkaloids and the substances from which they are obtained. The following is the order of the chapters in which they are treated. 1. The volatile alkaloids of tobacco and hemlock. 2. The constituents of opium. 3. Nux vomica, 4. Monk's-hood, deadly nightshade, and stramonium (aconitine, atropine, and daturine, the latter of which is justly regarded as identical with atropine). 5, Helebore and the different species of solanus (veratrine, solanine). It will perhaps give the best idea of the mode in which each poison is described if we select a single case, that of arsenic. First we find an account of the leading properties of arsenic and its principal compounds. Then follows a detailed account of arsenious acid, the symptoms produced by it, the quantity required to cause death, and the mode of treatment proper in cases of poisoning by it. Under this last head some curious experiments are quoted on the action of ferric hydrate as an antidote. The author of these experiments, Dr. Wm. Watt, found that dogs of average size were invariably killed by doses of from 3 to 6 grains of the acid. He then treated twelve more dogs with doses varying from 3 to 8 grains and followed them up—in some instances immediately, in others when symptoms of poisoning commenced—with doses consisting of two tablespoonfuls of the moist hydrate. In every case the dog recovered without exhibiting severe symptoms. "In another case six grains of the poison in solution were mixed with about fifteen parts by weight of the antidote, and the mixture, after standing twenty minutes, given to a dog; no appreciable effect whatever was observed, although the animal was closely watched for many hours."

Next we come to the chemical properties of the acid. Original experiments are given on the solubility of the acid in water, which appear to indicate that the solubility both of the opaque and crystalline variety depends greatly upon the conditions under which the experiment has been made. A long and elaborate account of the special tests for the acid next follows, and here we noitce one of the most valuable characteristics of the work. After the description of each important test, original experiments are given, showing the reaction obtainable with definite quantities of the materials, and thus affording a good and reliable measure of the delicacy of the test. We will give as an instance the experiments upon that form of Marsh's test in which the gas is decomposed in a tube by heat.

"1. 1-2,500th grain of arsenious acid in one hundred grains of liquid, or one part of the acid in the presence of 250,000 parts of fluid, yields in a very little time a very fine deposit, the inner portion of which has a brown colour, while the outer part has a bright metallic lustre.

"2. 1-5,000th grain, under a dilution of 500,000 parts of liquid, yields much the same results as 1.

"3. 1-10,000th grain, under a dilution of 1,000,000, yields a quite good deposit.

"4. 1-25,000th grain, under a dilution of 2,500,000, yields after some minutes, a very satisfactory deposit.

"5. 1-50,000th grain, in the presence of 5,000,000 parts of liquid, yields, after several minutes, a very distinct stain, the outer part of which has a dark metallic appearance, and the inner a brownish colour."

The author remarks that although Marsh's test will reveal the presence of arsenic in a greater state of dilution, Reinsch's test is really more delicate, because so much smaller a quantity can be employed. Used with the nicest care the latter test is capable of giving distinct evidence of the presence of 1-100,000th of a grain of the poison.

It is right to remark, in connection with Marsh's test, that the author has omitted to point out one of the chief difficulties attendant upon its use, namely, the frothing which, as every chemist knows, is generally produced in the presence of organic matter. He even directs us to estimate "the quantity of arsenious acid present in an organic liquid," . . "by introducing the solution into an active Marsh's apparatus, containing just sufficient sulphuric acid to evolve a very *slow* stream of gas," and to conduct the evolved gas into dilute nitrate of silver. The usual methods for the separation of the poison from organic matter are given, but they do not seem to prevent any points of novelty. Lastly, there is a useful paragraph entitled "Failure to Detect the Poison," in which the time required for its elimination is considered.

The other poisons are discussed in a manner similar to the above, and a good many useful and perhaps a few useless tests are added to those already employed; but our limits prevent us from giving further extracts. The account of the strychnine tests, their fallacies, and the substances which interfere with them, is particularly good. The substance most likely to be mistaken for strychnine appears to be woorara, the sulphuric acid solution of which gives a violet colour with potassic bichromate; but it may be distinguished by the circumstance that it gives a red or purple colour with sulphuric acid alone, whereas strychnine remains colourless.

We have not yet alluded to the chief characteristic of the work—the characteristic by which its name is justified. It is accompanied by an atlas of microscopic plates in illustration of the forms assumed by the principal precipitates and sublimates obtained in toxicological analysis. Not only have we the crystalline forms of the alkaloids and their compounds presented to us, but also those of many crystalline mineral precipitates, such as the potassic and sodic platino-chlorides, and even of some which, like baric and plumbic sulphates, and argentic arsenite and cyanide,

* A slight allusion to nitrobenzol occurs in page 561, where the author refers to Vol. v. of the Chemical News, in which Dr. Letheby's observations are recorded.

are not generally recognised as having a crystalline character. These illustrations are executed on steel, and are marvellously beautiful, and, as far as we are able to judge, equally accurate. It is pleasant to learn from the preface that science owes them to the skilful hand of a lady. Professor Wormley may well dedicate the book to his wife, for it owes a very large portion of its usefulness and importance to her work.

It would be hardly fair to the publishers to conclude without remarking that the style in which the book is got up is exceedingly good, that type, paper, and binding are all first-rate, and might almost have excused the publication of a bad book.

The Bible and Science. An Address delivered at the Church Congress, Wolverhampton, Oct. 3, 1867. By William Allen Miller, M.D., LL.D., Treas. and V.P.R.S., Professor of Chemistry in King's College, London.

The old prejudice which existed in the minds of many good persons against the cultivation of science, that it tends to promote scepticism in religion, has not yet died out, and we are bound to admit that the published opinions of some scientific men have given it new life. Of course this is very unreasonable, for it would be as unwise to denounce language because it may be perverted, or money because it may be spent on unworthy objects, as to denounce science because some of its professors are sceptics.

Religion has become so much a matter of dogma, of sect, of party, of antagonistic opinions on comparatively unimportant matters, of literal interpretation, and so forth, that Christianity is liable to be lost under the multitude of its coverings.

Those who regard religion as too sacred for every-day use, look with a kind of horror on the proposition that science is as much the work of revelation, as the religion of faith. The same power that permitted or inspired the Prophets and Apostles of old to reveal the Divine will to man, has permitted and permits man to discover some of the hidden mysteries of the universe. It is indisputable that the laws by which material things are governed have the same Lawgiver as those which regulate the spiritual world. The law of inverse squares is not more wonderful or more easy to grasp in its origin, permanence, and constancy, than the scheme of man's redemption and future happiness: only in the one case men can see and appreciate the induction which led to the discovery of the law, while in the other the faith which converts the doctrine of his redemption into a living vital truth is not so easily commanded.

From time to time we get such evidence as is afforded by the pamphlet before us, that a man may occupy a high position in the scientific world, and yet be a good Christian. Such evidence as this is all the more valuable as coming from a layman; and although the essay was read at a Church congress, and the author belongs to a a College which requires all her officers to be members of the Church of England, yet there is nothing churchy or sectarian about it. This will make it acceptable to a large body of cultivated men, who, disgusted at the wranglings and contentions, strifes, and heart-burnings of sects, and the present disorganised state of opinion in the Church of England, turn away from every church, and are disposed to cultivate rationalism rather than religion.

We attach the greatest importance to the non-sectarian tone of this essay; because it helps forward the grand idea that a churchman, or the member of any sect, is not necessarily a Christian, and that a Christian is not necessarily a sectarian.

CORRESPONDENCE.

ELECTIONS AT THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

Sir,—As a member of the Committee whose report to the Council of the Chemical Society you published last week, and which has not been signed nor agreed to by me, I feel myself called on to enter a protest against the concluding sentence of that report. I was present at earlier meetings of the Committee, but not at the last meeting, nor at the meeting of Council which received the report. I have privately expressed to members of the Committee my disapproval of the last sentence of the report.

Having voted against the candidates whose rejection raised the question of the abrogation of the by-law, and being still of opinion that I and those gentlemen who voted with me were in the right in the course we took, I cannot submit to having the occasion used as an opportunity for tendering advice as to the line of action to be followed by the Society in the event of members making an improper use of the ballot box. More than that, I could not recommend such an alteration of the by-law as is mentioned in the report, even in the event of a section of the Fellows banding themselves together to exclude a desirable candidate.

It appears to me, moreover, that the Society is in far more danger of falling helplessly into the hands of an official clique than of being deprived of the fellowship of valuable candidates through the combined action of private members. For my own part, I look rather upon a radical change in the manner of appointing the Council of the Chemical Society as the desideratum.

It is a notorious fact that the annual meeting for the election of officers and Council is, as a rule, poorly attended, and that the new Council is, as a matter of fact, elected by the votes of the retiring Council, whose individual members vote for that purpose in the capacity of private Fellows.

This state of matters, which is partly indicative of apathy on the part of the Society at large, and partly a consequence of the scattered state of the 500 members, is styled in official language a proof of the great confidence of the Society in its officers.

I regard it as a sign that election by vote does not answer as a mode of appointing the Council. In truth, at the present moment, the Council is not really delegated by the Society at large, but owes its present composition to a kind of apostolical succession.

Two courses present themselves to my mind as calculated to remedy this evil. The one is to deprive the Council of its votes in the election of its successor. Relieved of this depressing circumstance, the Society at large might perhaps be induced to take part in the election of a Council. The other course is to have the Council chosen by lot out of the whole 500 Fellows of the Society. Unpromising though this latter plan appears at first sight, I am inclined to think it would not work badly, and it would certainly deliver the Society from the kind of apostolic rule which I regard as one of the worst evils with which a Society can be afflicted.—I am, &c.,

J. Alfred Wanklyn.

London Institution, December 2, 1867.

LECTURE EXPERIMENTS.

To the Editor of the Chemical News.

Sir,—I should be glad to know if you would spare a column occasionally in your journal for an exchange of notes concerning lecture experiments. I am sure that to a large majority of the now numerous body of science

teachers such a column would be highly useful. As a rule the conditions of success are not stated in our text books when an experiment is described, and much time is lost in seeking them. Thus I have spent a considerable time in finding a neat and ready method of demonstrating the combustion of oxygen in hydrogen. No doubt all who have made the experiment have met with similar difficulties; but if there were a column such as I venture to suggest, the labours of one person would serve for all. As a contribution to such a column I would ask you to insert—

FLOATING SOAP BUBBLES IN CARBONIC ACID.

A vessel in which to hold the carbonic acid may conveniently and cheaply be made by getting five square pieces of glass—they should be at least 30 or 40 c. square,—then joining their edges by bibulous paper soaked in glue, so as to form a cubic shaped vessel. When the glue is dry a strip of cloth about two centimetres wide should be glued in the inside of the vessel, and lap over the edges, not only for protecting the ragged edges of the glass, but to prevent the bubbles from bursting. The carbonic acid used should be passed through a wash-bottle containing potassic carbonate, so as to free it from the vapour of hydrochloric acid, and then conducted into the cubic vessel until it is quite full. If a bubble now be blown with the glycerine and soap solution it may be floated easily on the carbonic acid. Should a draught carry it to the side of the vessel the strip of cloth will cause it to rebound again to the centre, and thus the bubble may float for many seconds, or even for a minute or two.—I am, &c., C. J. Woodward.

Middlesex Institute, Birmingham, December 11, 1867.

MISCELLANEOUS.

The late Professor M'Gauley.—We are requested to draw attention to the M'Gauley memorial fund (offices, 21, Cockspur Street, Charing Cross,) which is now being raised on behalf of the widow and family of the late Professor M'Gauley, Editor of the *Scientific Review*,—a man whose literary and scientific attainments made him much respected by all who knew him. As he had no opportunity of realising more than a bare sufficiency for his immediate wants, his wife and four children are unfortunately left utterly unprovided for, and a fund is now being raised for their relief.

Singular Explosion.—Under this head the *Times* gives the following account of the circumstances, as elicited at the inquest, under which a fatal accident took place during the preparation of hydrogen:—"Mr. Laurence, 9, Little George-street, Greenwich, said that he was a house painter and decorator, and that he was employed to make the lime-light to be used during the performance at the Greenwich theatre. On Saturday morning, the 16th ult., he went into the workshop at the back of his house, and while he was in the act of making it an explosion of hydrogen gas took place. He had placed some old nails and some scraps of iron in a large glass vessel, and he then poured three pints of water into the vessel. After that he poured some sulphuric acid into the jar. There were three pints of water in the vessel, and when he had poured three to six ounces of the acid into it an explosion took place, and he was covered from head to foot. He then heard loud shrieks, and upon rushing out of the workshop he found that two of his daughters had been injured. The deceased had her throat cut, and blood was rushing from the wound. He placed her in a cab, and she was taken to Guy's Hospital. Witness made the hydrogen gas every other day in a bag of three feet nine cubic inches. That lasted two nights. He had studied chemistry for twenty-five years, and he believed that the cause of the explosion was the coldness of the preceding night acting upon an old solution of water, iron, and sulphuric acid that was in the glass jar at the time that he poured the fresh solution into it through a funnel. The old solution was crystallised. He was not injured." The explosion is peculiarly "singular," since as far as we can understand the circumstances as described by our contemporary, the explosion took place in one room while its effects were chiefly felt in another; and, moreover, no mention is made of any flame by which ignition could have been caused. If the vessel burst simply from an enormous pressure of gas, this could only have happened by the apertures being purposely tightly closed. We can scarcely imagine a man having "studied chemistry for twenty-five years" making hydrogen without using an acid funnel. If anything were wanted to complete the mystification, the explanation of the cause of the explosion, given by the student of twenty-five years' standing, is sufficient. The jury returned a verdict of "Accidental death," recommending with naïveté that there should be more caution used in future while hydrogen gas was being made; and the coroner finished by saying that "he did not think such a dangerous *compound* (!) ought to be made except in places properly allotted to it." This remarkable commentary shows that "Crowner's" Chemistry is as profound as "Crowner's" Law.

Edwards v. Norris. — In Chancery. — This case relates to the chemical works of the defendants at Sowerby-bridge, in the West Riding of Yorkshire. The bill prays "That the defendants, their agents, and workmen, may be restrained from discharging, or causing, or permitting to be discharged from their works at Sowerby-bridge, any vapour, or sulphuric acid, or sulphurous acid, or any other noxious or offensive gas, vapour, or substance, so as to occasion any nuisance or injury to the plaintiff's property called Pye Nest, or the property belonging to the plaintiff and his brother Joseph Priestly Edwards as tenants in common, or to the timber, or other shrubs or herbage on the same respectively." The second clause asks for an inquiry as to damage. Lord Romilly, in delivering judgment in the Rolls Court on December 4th, said—"A vast amount of evidence has been gone into on both sides to prove and disprove the case of the plaintiff. The burden of proof lies on the plaintiff, and after a very long and detailed examination of the evidence on both sides, I am of opinion that the plaintiff has failed in giving the proof which is necessary to induce me to give him a decree. The evidence is so voluminous and so varying, that I should only become obscure, and fail in showing the true grounds of my decision, if I were to attempt to state in detail what, in my opinion, each witness establishes, and in what parts his evidence falls short of the required proof. But I will state, generally, what I consider to be proved by the evidence, and the points in which I think the evidence is defective. I think it is clearly proved that vegetation and trees in the plaintiff's park are seriously injured by noxious vapours. It is also, in my opinion, proved that the presence of sulphuric acid, or sulphurous acid, is prevalent on the leaves and grass in various places in the plaintiff's park. It is also proved that a very considerable amount of sulphurous acid escapes from the works of the defendants—as much as 14 ounces per minute from the cupola chimney, and 11 ounces per minute from the lofty chimney, and that this occurs although they are so constructed as to consume their own smoke, and this on the most approved method, and although no dense vapour escapes from either chimney. This goes a great way in the plaintiff's favour, but I think the evidence fails in showing that the injury to the trees and vegetation is attributable exclusively, or indeed mainly, to the defendants' works. The escape of sulphur from the other chimneys at Sowerby-bridge, according to the evidence before me, amounts to six times as much as

that which escapes from the defendants' works; besides which, there are bleaching works where sulphur is burnt, and where, consequently, a considerable escape of sulphurous acid must take place; and although the evidence does not enable me to estimate accurately the amount which does so escape, it must, I think, be considerable. The defendants' works are also close to the gas works, from whence it appears that some escape of sulphuretted hydrogen takes place, and although the amount of it is not proved, yet some of it must occur. This evidence might be neutralised if it were established that the injury to the trees and vegetation took place in the immediate neighbourhood of the defendants' chemical works and where the vapour from these works alone could extend. But this is not so. The injury to the trees is very capricious, and some which stand very near the works are not affected at all, while others, more distant, are very seriously injured. The attempt to establish that this is occasioned by accidental shelter is very far from producing conviction in my mind as to the truth of the cause alleged. That the defendants' works do contribute their quota of injury to the plaintiff I do not doubt, but I am by no means clear that if their works were put an end to to-morrow the plaintiff's park would benefit by it, or that it would not appear to be in a position just as injurious the next year as if their works had been carried on. I have in vain endeavoured to reconcile the evidence with any particular theory as to the place from whence the noxious vapour flows, and I believe it to be impossible to do so. I think the most probable solution of the case is that the whole atmosphere around is impregnated with substances more or less injurious to vegetable life, and that these substances affect some trees, and some places, more than others—not merely because the wind is principally in that direction, as is the case on the west side of the trees, of which some striking instances are shown, but also arising, in some measure, from the accidents of the soil, and other natural accidents, which render some trees more susceptible of this peculiar injury than others. At all events, after trying very much, I have failed in being able to trace distinctly the injury proceeding from the defendants' works as to justify me in granting any injunction. In addition to this failure on the part of the plaintiff, there is another circumstance which, in my opinion, tells much in support of the view that I have taken of the case on the question of the relief sought by this bill. The works of the defendants were established upwards of forty years ago—I think in 1819. Since then they have much increased, and particularly since 1857. But simultaneously with the increase, or nearly so, improvements have been made which, according to all the evidence, which on this part of the subject is all one way, have materially diminished the escape of noxious vapours. And this was particularly accomplished by alterations and improvements made in the year 1859. I have found it impossible to arrive, on the evidence, even at a distant approximation as to the amount of noxious vapours which escape from the defendants' works now as compared with those which escaped from them prior to the year 1859. For anything that appears, it may have been worse then than it is now; and if so, the question arises—When did the vapours first begin to be injurious to the neighbouring vegetation? I do not believe that it has ever been decided that prescription to foul a running stream, or to impregnate the air with noisome or noxious vapours can be established against the public; but, unquestionably, it can be established against a particular individual who has seen it going on for upwards of twenty years, and has taken no steps to prevent it. It is incumbent, in such a case that the suffering proprietor should seek the assistance of this court as soon as the nuisance is really perceptible, according to the doctrine laid down in many cases, and which I followed lately in the case of Goldsmid *v.* the Tunbridge Wells Commissioners. On this subject, in the present case, I am left in the dark. My surmise, drawn from the evidence, is—that if the present injury proceed from these works, as is alleged by this bill, this injury must have been perceptible more than twenty years ago, and as it is from the cupola chimney, which is said to be the main cause of the injury, and as this has been in the same situation since 1859, when it was made much less hurtful than it was before the present state of the vegetation is more attributable to the general increase of the neighbouring manufactures than to these works themselves; and in my opinion I am unable, as I am invited to do, to draw any safe conclusion or analogy from the effects produced by London smoke, or by that of our other large towns, even if I had, which I have not, any trustworthy evidence on the subject as applied to the effects of a mass of manufactures with smoking chimneys, contracted in a narrow valley, and as to which the vapours must be for the most part confined. I have therefore come to the conclusion that the plaintiff has not made out his case; and as the burden of proof rests on him, his bill must be dismissed. I had thought at one time of offering to him an issue; but, having regard to the lapse of time, which cannot be tried by an issue, and also considering that according to my experience in this court an issue entails great expense, and ultimately, for the most part, leaves the parties very much as they were before, I have determined not to adopt this course, but to dismiss the bill *simpliciter*; and therefore I dismiss the bill with costs."

MEETINGS FOR THE WEEK.

Monday—Medical, 8 p.m.
Wednesday—Society of Arts, 8 p.m.
—— Geological, 8 p.m.
—— London Institution, 6½ p.m.
Thursday—Royal, 8½ p.m.
—— Zoological, 4 p.m.
—— Chemical, 8 p.m.
—— Philosophical Club, 6 p.m.

TO CORRESPONDENTS.

H. Boyes.—The cause of the effervescence of aërated liquids when a foreign body is introduced into them (*i.e.*, bread into champagne) was fully explained in a paper by Mr. Tomlinson, F.R.S., which appeared a few months ago in the Chemical News.

E. Kernan.—The *Moniteur Scientifique* is a very good scientific journal. The publisher can supply you from our office. *Les Mondes* can also be sent from our office. The subscription, post free, is £1. 12s. per annum, in advance.

W. Schofield.—The matter is under consideration. We will communicate again on the subject.

Professor Weltzein.—Your letter arrived some time ago, but not the book.

J. Bournes.—Our publisher has answered your first question. 2. Galloway's chemical tables are sufficiently large for class teaching, but we believe they have not yet been printed with new atomic weights and most recent formulæ.

X.Y.Z.—In examining white lead mixed with oil, it is best to extract the oil with ether or chloroform, and then examine the residue with acids, &c., in the ordinary way. If you ignite to drive off the oil you will in all probability alter the composition of the lead compound.

Hg.—There is no particular physical reason why the other planets should not be inhabited. Venus would, however, be preferable to Mercury to human beings constituted like ourselves, for on the former planet a body weighing 1lb. on the earth would weigh 0·98 lb., and the light and heat received would be 1·91 times that received by the earth. On Mercury a pound weight would weigh 1·106 lbs., whilst the proportion of light and heat would be 6·68 times that received by the earth. This excessive radiation may, however, be in a great measure intercepted by a dense atmosphere.

Communications have been received from J. Imray, C.E.; G. H. Jennings (with enclosure); J. Gra. Tatters; W. A. Jackson; S. Scott (with enclosure); H. E. Roscoe, F.R.S. (with enclosure); J. Baxendell, F.R.S. (with enclosure); H. Simkinson; Dr. F. C. Calvert, F.R.S. (with enclosure); Dr. Sansom (with enclosure); J. Masterman; Professor Tyndall, F.R.S.; J. Ellison (with enclosure); H. Spence; M. Williamson; Jabez Hughes; W. Scott; G. F. Rodwell; J. A. Wanklyn (with enclosure); Rev. F. Sonley Johnstone; T. W. Cowburn; G. F. Barker, M.D. (with enclosure); Dr. A. W. Hofmann, F.R.S.; Youngman, Brothers; Professor J. H. Pepper; H. K. York; H. S. Bradford (New York); G. Maurice; R. Reading; Young's Paraffin Light and Mineral Oil Company; Nicholson, Taylor, and Co.; H. R. Marsden; M'Dougall, Bros.; D. Knight; W. Smith and Co.; H. Baillière; E. Riley; R. Le Neve Foster; G. W. Eccles; Dr. Quesneville (with enclosure).

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THE CHEMICAL NEWS.

VOL. XVI., No. 420.

CRYSTALLOGRAPHY AND THE BLOWPIPE.

By W. A. ROSS, Captain, R.A.

I HAVE the pleasure to inform you of a new feature in blow-pipe manipulation lately discovered by me, which I am sanguine enough to hope may add another to the many results obtained in chemical and mineralogical analysis by this invaluable little instrument.

It struck me that, as the decomposition of light by inflection or diffraction is analogous to that by absorption and transmission through a prism, and as the latter operation has been applied so successfully to the recognition of blow-pipe flames of metals, as lithium, barium, &c., in the spectroscope, small *bladders* or *bubbles* of borax of sufficient tenuity to diffract rays of light, if containing certain metals or oxides in solution, would afford, when cool, corresponding chromatic rays, in daylight. It is true that Sir I. Newton attributed the different colours obtained by diffraction solely to the relative thickness or distance between the reflecting surfaces, but, as Sir D. Brewster remarks, he "inferred that they were produced by a singular property of the particles of light, in virtue of which they possess, at different points of their paths, *fits* or *dispositions* to be reflected from, or transmitted by transparent bodies. Sir Isaac does not pretend to explain these *fits*, but terms them *fits of transmission and fits of reflection*." Now why should not these "fits" be caused by some peculiarities in the composition of the reflecting body? The colours on a soap bubble are surely not solely attributable to its thickness and thinness in different parts; and we must all recollect as boys how not only the quantity but quality of the soap was a *sine qua non* of success.

The following table, which I have prepared from actual experiment in every case, will, I think, fairly show that a richer play of colour is yielded by metallic solutions than in the pure *vesicula* of borax, and it appeared to me very remarkable that such a highly colouring agent of borax as cobalt should yield nearly transparent *vesicula* showing little or no iridescence. I remarked also that a copper vesicle gave almost the same play of colours as is seen in the ore called "peacock copper" in which a rich blue is very predominant, while in several vesicles of bismuth, which I made, no blue at all could be observed, but a great predominance of pale green.

Carbonate of baryta,	very slightly	iridescent
Borax	,,	,, ,,
Microcosmic salt	,,	,, ,,
Oxide of copper ..	,,	highly ,,
,, cobalt ..	nearly clear	vesicle
,, nickel ..	slightly	iridescent
,, bismuth ..	very highly	,,
,, tin	highly	,,
,, manganese	very highly	,,
Nitrate of potash ..	highly	,,
Iodide of potassium	very highly	,,

I made no attempt to classify the colours reflected by different metals in solution, but they always appeared in prismatic bands of blue, green, yellow, orange, red, &c.

Next day a new feature in these *vesiculæ* attracted my attention, which I hope will add to their importance as analytical agents, and develope besides an elegant application of the science of crystallography to blow-pipe examination which it has not yet received.

Observing that a cloudy film containing white spots had gathered over the vesicle holding *carbonate of baryta* in solution, I examined the spots with a microscope, and found them to be round radiated crystals having a dark nucleus or centre.

I then made a borax vesicle containing *nitrate of baryta*, and allowed it to stand for several hours, after which a film displaying similar crystals, but with a *white* nucleus or centre, appeared. A vesicle containing carbonate of potassa showed, after a time, a film without crystals exactly like finely ground glass, *Carbonate of magnesia* appeared in beautiful crystals, like the flowers of a convolvulus, having six petals, with a double rim or edge, and a dark nucleus. *Sulphate of magnesia* displayed similar flower-like crystals without the rim or nucleus.

I now found to my surprise and pleasure that every one of thirteen borax vesicles I had placed on cotton overnight was covered more or less with similar crystals peculiar to itself, and strongly differing from those of the other vesicles, unless, as in the case of magnesia, they contained a common base. Thus *nitrate of silver* appeared in almost perfect stars, radiating from an extremely white central point which again was surrounded by a dark aureola. A *silicate of lithia* (lithionglimmer) also appeared in stars, but of a perfectly different shape, having no nucleus and large cups of unequal length. *Oxide of cobalt*, the vesicle containing which was colourless when newly made, now appeared in a series or net-work of transparent crystals like the glass manufacture termed "imitation ice." *Strontianite* seemed to crystallise in octohedral planes having large dark nuclei, while *bichloride of platinum* produced nearly circular flowerets having an inner ring but no nucleus, and veined like the wing of a fly. The *teroxide of bismuth*, on the contrary, appeared in crystals like extremely white and small feathers.

Thus it will be seen that, whatever the cause, different solutions of metals or their oxides in borax, produce, when blown into *vesiculæ* and allowed to stand for a night, different and peculiar crystals; a fact which I have allowed myself to hope, will enable the careful observer to determine the composition of these substances more rapidly, certainly, and easily, than by any other method, as this one is effected by the operation of the laws of nature herself. All that is required seems to me to be a careful representation and classification of these crystals obtained by means of a powerful microscope, and as the vesicles, with the exception of the crystals upon them, are, in dry weather, generally transparent, these latter might almost, I should think, be magnified and represented by means of the polariscope.

I have made sketches of thirteen crystals observed by me, but although they convey perhaps a general idea of the shape, they are very far from showing, in the least degree, the beautiful detail and variety observable in the structure of each of these crystals. I observed also that these vesicles develope electricity, some in a greater degree than others, which may be referable to their different composition. Seeing that two of them adhered together so fast that they could not be separated without breaking one of them, although quite dry and smooth on the outside, I applied a piece of rubbed sealing wax to several, and attracted most of them vigorously, but some, on the other hand, did not show the least attraction.

Some of the saliferous vesicles—notably the nitrate of potassa, and carbonate of soda—delequesced so rapidly that although they crystallised, I failed to observe the shape of the crystals,* and indeed in damp weather, like the present, the general results of this system are bad—I cannot to-day obtain a second set of crystals of carbonate of soda, the vesicle containing it deliquescing into holes before the crystals can be even formed.

When the phenomena of these vesicles have been observed, they can be be remelted into beads by holding the platinum wire sustaining them in the gas or spirit lamp flame, in which process the thin shell of the vesicle

* I obtained and sketched crystals of these afterwards.—W. A. R.

effloresces in a manner apparently peculiar to the salt which it contains. Thus oxide of bismuth has a *frothy*, nitrate of silver a *creamy*, efflorescence. If a newly made vesicle be applied to the gas flame, no efflorescence at all takes place, but the borax melts transparently down to its bead.

It now only remains for me to explain how the process of vesiculation is carried out. I perform it as follows:—I fuse a bead of borax on the platinum wire in the usual way, and charge it with the salt or oxide of which the crystals and diffractive colours are desired. After holding it for some time in the *reducing* flame, I withdraw both the bead and the blowpipe from the flame, keeping the latter still pressed against my month and blowing through it; I then bring the jet of the blowpipe rapidly opposite the ring of the platinum wire (which should be of the size of a pin's head and as round as possible), through which the stream of air issuing from it blows out a vesicle or bladder formed of the fluid bead of borax and the substances contained in it.

Woolwich, Dec. 2, 1867.

ON A NEW CLASS OF BODIES HOMOLOGOUS TO HYDROCYANIC ACID.*

By A. W. HOFMANN, LL.D., F.R.S.

The typical transformation which hydrocyanic acid undergoes when submitted, under appropriate circumstances, to the action of water, is capable of assuming two different forms when accomplished in its homologues.

If the hydrocyanic molecule be found to fix the elements of two molecules of water, yielding ultimately formic acid and ammonia, it is obvious that the atom group which in the homologues of hydrocyanic acid we assume in the place of hydrogen, may be eliminated when these homologues are decomposed by water in conjunction either with formic acid or with ammonia. To take an example:—When acting with water upon the simplest homologue of hydrocyanic acid (upon cyanide of methyl), we may expect to see the methyl-group separating either in the form of methyl-formic, *i.e.* acetic acid, or in the form of methyl-ammonia, *i.e.* of methylamine. The difference of the two reactions and their relation to the metamorphosis of hydrocyanic acid itself are exhibited by the following equations:—

$$\underbrace{CHN}_{\text{Prussic acid.}} + 2H_2O = \underbrace{CH_2O_2}_{\text{Formic acid.}} + H_3N.$$

$$1.\ \underbrace{C_2H_3N}_{\text{Cyanide of methyl } \alpha.} + 2H_2O = \underbrace{C_2H_4O_2}_{\text{Methylformic (acetic) acid.}} + H_3N.$$

$$2.\ \underbrace{C_2H_3N}_{\text{Cyanide of methyl } \beta.} + 2H_2O = \underbrace{CH_2O_2}_{\text{Formic acid.}} + \underbrace{CH_5N}_{\text{Methylamine}}.$$

The former one of these processes of transformation is familiar to chemists from the study of the hydrocyanic ethers or nitriles. The first member of this remarkable group of bodies (cyanide of ethyl) was discovered by Pelouze; the general character of their transformation was subsequently established by the beautiful investigations of Kolbe and Frankland on the one hand, and by those of Dumas, Malaguti, and Le Blanc on the other.

Researches in which I have been engaged during the last few weeks have proved that the second process of transformation does not less frequently occur. Indeed I have found that there corresponds to each of the hydrocyanic ethers or nitriles known hitherto, a second body of precisely the same composition but of absolutely different properties. These substances, when changed by water, undergo the transformation which is exhibited by the last one of the three above equations.

A happy experiment has led me to the discovery of this new class of bodies. In a lecture I wanted to exhibit the interesting transformation of ammonia into prussic acid by means of chloroform, which was first observed by M. Cloez, and which illustrates so well our present views on quantivalence. When the two substances alone are allowed to act upon one another, this reaction can be rapidly accomplished only at a high temperature and consequently under pressure. I order to shorten the process (in one word, in order to exhibit this important reaction in a lecture-experiment), I had added potash to the mixture for the purpose of fixing the newly formed prussic acid, and was delighted to find that a few seconds' ebullition was sufficient to yield a considerable amount of cyanide of potassium, so as to furnish, after the addition of the two salts of iron, a large quantity of Prussian blue. On subsequently repeating the experiment with some of the derivatives of ammonia, more especially with several primary monamines, I was astonished to observe in each case a powerful reaction giving rise to the evolution of vapours of an almost overwhelming odour, strongly recalling that of prussic acid. But few experiments were necessary for the purpose of isolating the odoriferous bodies. The compounds thus formed are the substances isomeric with the hydrocyanic ethers or nitriles hitherto examined.

From the host of bodies which were thus suddenly thrown into view, it was necessary to single out the compound of a particular series in order to determine by accurate experiments the nature of the new reaction. The facility of procuring the necessary material, as well as old predilections, suggested the phenyl-series as the one to be examined in the first place. I beg leave to submit to the Royal Society a brief account of the mode of preparation, and of the principal properties, of the new derivative of aniline.

Cyanide of Phenyl.

A mixture of aniline, chloroform, and alcoholic potash yields on distillation a liquid of a powerfully aromatic but, at the same time, hydrocyanic-acid-like odour. The vapour of the liquid gives rise to a peculiar bitter taste, and causes, moreover, in the throat the suffocating sensation so characteristic of hydrocyanic acid. On redistilling the liquid, alcohol and water pass first, and ultimately an oily body is procured, which, in addition to the smelling substance, still contains a large amount of aniline. The latter is separated by oxalic acid, when the powerfully smelling compound remains in the form of a brownish oil. Freed from water by hydrate of potassium and purified by distillation, the new body presents itself as a mobile liquid, exhibiting a greenish colour in transmitted, and a beautifully blue colour in reflected light. This colour does not disappear by distillation even in a current of hydrogen.

The analysis of the blue oil has established the formula

$$C_7H_5N.$$

The compound is thus seen to be isomeric with benzonitrile, discovered by Fehling, from which it differs, however, in all its properties. In order to distinguish the new compound from benzonitrile I will call it *cyanide of phenyl*, without intending, however, by selecting this name, to express any particular view as to its constitution. The formation of cyanide of phenyl is represented by the following equation:—

$$\underbrace{C_6H_7N}_{\text{Aniline.}} + \underbrace{CHCl_3}_{\text{Chloroform.}} = \underbrace{C_7H_5N}_{\text{Cyanide of phenyl.}} + 3HCl.$$

Cyanide of phenyl cannot be volatilized without undergoing decomposition. During distillation the thermometer marks for some time the constant temperature of 167°,

* Paper sent to the Royal Society during the recess.

which may be taken as the boiling-point of cyanide of phenyl. Then the temperature rises rapidly to from 220° to 230°. The brown liquid which now distils is destitute of odour, and solidifies on cooling to a crystalline mass, easily purified by solution in alcohol, but not yet more minutely examined. Cyandine of phenyl is remarkable for the facility with which it combines with other cyanides. The compound with cyanide of silver is particularly beautiful. The behaviour of cyanide of phenyl with acids is more especially characteristic. Scarcely changed by the action of alkalies, it cannot be left in contact even with moderately dilute acids without undergoing alteration. When submitted to the action of concentrated acids, the liquid bursts into ebullition, and the solution, after cooling, contains only formic acid and aniline.

$$\underbrace{C_7H_5N}_{\text{Cyanide of phenyl.}} + 2H_2O = \underbrace{CH_2O_2}_{\text{Formic acid.}} + \underbrace{C_6H_7N}_{\text{Aniline.}}$$

Benzonitrile, isomeric with cyanide of phenyl, is known to be slowly attacked by acids, but to be rapidly transformed by alkalies into benzoic acid and ammonia.

$$\underbrace{C_7H_5N}_{\text{Benzonitrile.}} + 2H_2O = \underbrace{C_7H_6O_2}_{\text{Benzoic acid.}} + H_3N.$$

The transformation of benzonitrile into benzoate of ammonium, as, indeed, the transformation of the nitriles into the ammonium-salts of the respective acids generally, is not accomplished in one single bound. By fixing only one molecule of water, benzonitrile is first converted into benzamide.

$$\underbrace{C_7H_5N}_{\text{Benzonitrile.}} + H_2O = \underbrace{C_7H_7NO}_{\text{Benzamide.}}$$

Nor is the corresponding term of the isomeric series wanting. This substance has long been known as phenyl-formamide or formanilide,

$$\underbrace{C_7H_5N}_{\text{Cyanide of phenyl.}} + H_2O = \underbrace{C_7H_7NO}_{\text{Phenyl-formamide.}}$$

But, in addition to phenyl-formamide, there figures in this series a second intermediate compound, the analogue of which among the derivatives of benzonitrile is not yet perfectly known.* This compound is the well-defined base which some time ago I described as methenyldiphenyldiamine, and which may be looked upon as formed by the association of a molecule of cyanide of phenyl with a molecule of aniline. The successive changes which cyanide of phenyl undergoes when submitted to the influence of water are thus exhibited by the following series of equations:—

$$\underbrace{C_{14}H_{10}N_2}_{\text{2 mols. cyanide of phenyl.}} + 2H_2O = \underbrace{CH_2O_2}_{\text{Formic acid.}} + \underbrace{C_{13}H_{12}N_2}_{\text{Methenyldiphenyldiamine.}}$$

$$\underbrace{C_{13}H_{12}N_2}_{\text{Methenyldiphenyldiamine.}} + H_2O = \underbrace{C_7H_7NO}_{\text{Phenyl-formamide.}} + \underbrace{C_6H_7N}_{\text{Aniline.}}$$

$$\underbrace{C_7H_7NO}_{\text{Phenyl-formamide.}} + H_2O = \underbrace{CH_2O_2}_{\text{Formic acid.}} + \underbrace{C_6H_7N}_{\text{Aniline.}}$$

A glance at these formulæ shows that the metamorphosis of phenylic cyanide is perfectly analogous to that of phenylic cyanate, which I have studied at an earlier date.

$$\underbrace{C_{14}H_{10}N_2O_2}_{\text{2 mols. cyanate of phenyl.}} + 2H_2O = \underbrace{CH_2O_3}_{\text{Carbonic hydrate.}} + \underbrace{C_{13}H_{12}N_2O}_{\text{Diphenyl-urea.}}$$

$$\underbrace{C_{13}H_{12}N_2O}_{\text{Diphenyl-urea.}} + H_2O = \underbrace{C_7H_7NO_2}_{\text{Anhydrous carbonate of aniline.}} + \underbrace{C_6H_7N}_{\text{Aniline.}}$$

$$\underbrace{C_7H_7NO_2}_{\text{Anhydrous carbonate of aniline.}} + H_2O = \underbrace{CH_2O_3}_{\text{Carbonic hydrate.}} + \underbrace{C_6H_7N}_{\text{Aniline.}}$$

Cyanide of Ethyl.

After having fixed in the phenylic group the general characters of the reaction, my attention was very naturally directed to the ethylic series. For this purpose, it was first necessary to procure ethylamine in rather considerable quantities. Happily in this case the liberal co-operation, so often experienced, of my friend Mr. E. C. Nicholson, was again at hand. Interesting himself with a cordiality, for which I cannot sufficiently thank him, in the continuation of my researches on the ethylic bases, Mr. Nicholson had placed at my disposal the product of the action of ammonia on iodide of ethyl produced in a single operation performed in one of his great autoclaves on 20 kilogs. of iodide of ethyl.

Thanks to the happy alliance between science and industry, which characterises our times, I was thus enabled to study the transformation of ethylamine under the influence of chloroform on a rather large scale.

On gradually introducing a mixture of an alcoholic solution of ethylamine and chloroform into a retort containing powdered potassic hydrate, a most powerful reaction takes place; the mixture enters into ebullition, and a liquid distils over, the penetrating odour of which surpasses anything that it is possible to conceive. Besides the odoriferous body the product of the distillation contains ethylamine, chloroform, alcohol, and water, and a considerable number of rectifications are required in order to isolate the cyanide of ethyl from this mixture.

As the substance is rather volatile, the frequently repeated fractional distillations become a most painful operation, and more than once, while I have been engaged in these experiments, my laboratory has been almost inaccessible. Thus with a temperature of 30° I have found it desirable to interrupt for the time the preparation in the pure state of the cyanide of ethyl, and to resume it at a more favourable season.

I was nevertheless curious to study, even now, a true homologue of cyanide of ethyl in order to compare its properties with those of cyanide of phenyl. The boiling-points of the amylic compounds being within convenient limits, I was induced to select the amyl-series as presenting the greatest chance of success.

On submitting amylamine to the action of chloroform, the same phenomena are observed as in the analogous reaction between chloroform and aniline. One molecule of amylamine and one molecule of chloroform contain the elements of one molecule of cyanide of amyl and three of hydrochloric acid:—

$$\underbrace{C_5H_{13}N}_{\text{Amylamine.}} + \underbrace{CHCl_3}_{\text{Chloroform.}} = \underbrace{C_6H_{11}N}_{\text{Cyanide of amyl.}} + 3HCl$$

The cyanide of amyl is a transparent colourless liquid lighter than water, insoluble in water, but dissolved by alcohol and ether, of an oppressive odour, resembling at the same time that of amylic alcohol and of hydrocyanic acid. Its vapour possesses, in a still higher degree than that of the cyanide of phenyl, the property of producing on the tongue an insupportably bitter taste, and of giving rise in the throat to the sensation of suffocation, so characteristic of hydrocyanic acid.

The cyanide of amyl may be distilled without decomposition. It boils at 137° C., that is, at a temperature 8°

* Shortly before his death, Gerhardt was engaged in experiments on the action of pentachloride of phosphorus on the amides, a brief account of which was subsequently published by M. Cahours. Among other substances, I find that, by acting with pentachloride of phosphorus upon benzanilide, Gerhardt obtained a chloride, $C_{13}H_{10}NCl$, which yields with ammonia a crystalline substance. It can scarcely be doubted that this compound is the derivative of benzonitrile corresponding to methenyldiphenyldiamine,

$$C_{13}H_{10}NCl + H_3N = C_{13}H_{12}N_2 + HCl.$$

lower than the boiling-point of its isomer, capronitrile. It will be remembered that the boiling point of cyanide of phenyl is lower than that of benzonitrile.

Under the influence of alkalies and acids, the cyanide of amyl behaves in the same manner as the phenylic cyanide. Though only slightly attacked by alkalies, it is decomposed by acids with a violence which is almost explosive; a short ebullition with water is sufficient to transform it into formic acid and amylamine:—

$$\underbrace{C_6H_{11}N}_{\text{Cyanide of Amyl.}} + 2H_2O = \underbrace{CH_2O_2}_{\text{Formic Acid.}} + \underbrace{C_5H_{13}N.}_{\text{Amylamine.}}$$

In order to fix this equation by numbers, I have carried out the reaction by means of dilute sulphuric acid. The formic acid was then distilled off and transformed into a sodium-salt, and analysed as formate of silver; the residue in the retort furnished, on addition of an alkali, amylamine in considerable quantities. It was identified with that obtained from cyanate of amyl, both by the determination of its boiling-point and by the analysis of the platinum-salt.

The transformation of the cyanide of amyl, like that of the cyanide of phenyl, does not take place at a single step; intermediate combinations corresponding to methenyl-diphenyldiamine and to phenylformaimde are produced, but I have not yet obtained them in a state of purity.

I have designated the body described in this note by the name of *cyanide of amyl*; I am of course aware that the same name has been given to the substance produced by the action of cyanide of potassium on the sulph-amylates; but as the latter compound, in consequence of its transformation into caproic acid and ammonia, has a right to the name *capronitrile*, I have thought it desirable to distinguish, provisionally at least, the new product by the name of cyanide of amyl.

The examination of the cyanides of amyl and phenyl establishes in a positive manner the existence of a group of bodies isomeric with the nitriles derived from the ordinary alcohols and phenols.

I have not as yet pursued more minutely the study of the other terms of these groups; in fact the field opened by these new observations presents questions much more attractive. The existence of the new homologues of hydrocyanic acid allow us to foresee the formation of quite another series of homologues of cyanogen. These bodies will be produced by the action of chloroform on the diamines. Ethylene-diamine, for example, will thus be transformed into the dicyanide of ethylene:—

$$\underbrace{C_2H_8N_2}_{\text{Ethylene-diamine.}} + \underbrace{2CHCl_3}_{\text{Chloroform.}} = \underbrace{C_4H_4N_2}_{\text{Dicyanide of ethylene.}} + 6HCl$$

CARBOLIC OR PHENIC ACID AND ITS PROPERTIES.*

By Dr. F. CRACE CALVERT, F.R.S., &c.

(Continued from page 298.)

We will now rapidly glance at the applications which have been made of this remarkable substance for sanitary purposes, in medicine, agriculture, and manufactures.

The disinfecting or rather antiseptic properties of carbolic acid are very remarkable. The beautiful researches and discoveries of M. Pasteur† have shown that all fermentation and putrefaction is due to the presence of microscopical vegetables or animals, which, during their vitality, decompose or change the organic substances, so as to produce the effects which we witness, and as carbolic acid exercises a most powerful destructive action upon these microscopic and primitive sources of life, carbolic acid, therefore, is an antiseptic and disinfectant much more active and much more rational than those generally in use.

It is necessary that I should here make a few remarks, explanatory of the distinctions between *deodorizers*, *disinfectants*, and *antiseptics*:—

Deodorizers.—All substances merely acting as such are neither disinfectants nor antiseptics, as they simply remove the noxious gases emitted from organic matters whilst in a state of decay or putrefaction, without having the property of arresting decomposition or fermentation. For it has been proved that the source of infection or contagion is not due to noxious gases or bad smells (being merely indicators of its probable existence), but, as we shall see presently, to microscopic spores floating in the atmosphere, and which by their ulterior development and propagation, are believed to be the true source of contagion.

Disinfectants.—Under this head may be classed bleaching powder, or chloride of lime, sulphurous acid, and permanganate of potash; they first act as deodorizers, and then as disinfectants, but they must be employed in large quantities to thoroughly oxidize or act upon organic matters, so as to prevent them from again entering into decomposition, but still it is known that if the organic substances so acted upon are exposed to the atmosphere, they will again experience decay and putrefaction; they are, in fact, more destructive agents than disinfectants, and they are never antiseptics.

Antiseptics.—Antiseptics, such as corrosive sublimate, arsenious acids, essential oils, carbolic acid, &c., act as such by destroying all source of decay and decomposition, that is to say, they destroy or prevent the formation of the germs of putrefaction and fermentation, without acting upon the mineral or vegetable matters present. The advantage of their use is, therefore, that they act, when used in small quantities, upon the primary source of all organic matters in a state of decay; further, they are deodorizers, for they prevent the formation of offensive odours, and consequently they are antiseptics, disinfectants, and deodorizers. The great advantages which carbolic acid possesses over all other antiseptics are, that it cannot be used for any illegal purpose, as arsenic and corrosive sublimate.

And allow me further to add that disinfectants, such as chlorine, permanganate of potash, or Condy-fluid, operate by oxidizing not only the gaseous products given off by putrefaction, but all organic matters with which they may come in contact; whilst carbolic acid, on the contrary, merely destroys the causes of putrefaction, without acting on the organic substances. The great difference which therefore distinguishes them is, that the former deals with the effects, the latter with the causes. Again, these small microscopic ferments are always in small quantities as compared to the substances on which they act, consequently a very small quantity of carbolic acid is necessary to prevent the decomposition of substances; therefore, its employment is both efficacious and economical.‡ Moreover, carbolic acid is volatile; it meets with and destroys, as Dr. Jules Lemaire says,‖ the germs or sporules which float in the atmosphere, and vitiate it; but this cannot be the case with Condy's fluid, chloride of zinc or iron, which are not volatile, and which act only when in solution, and are mere deodorizers. This is why carbolic acid was used with such marked success, and therefore so largely, in England, Belgium, and Holland during the prevalence of cholera and of the cattle plague.§ Mr. W. Crookes, F.R.S., not only states: "I have not yet met with a single instance in which the plague has spread on a farm where the acid has been freely used;" but he has also proved, by a most interesting series of experiments, that the gases exhaled from the lungs of the

* Lecture before the Society for the Encouragement of National Industry in France.

† See "Comptes Rendus de l'Academie des Sciences" for several years past, and my lecture at the Society of Arts, 1863-65.

‡ See remarks at the end of lecture.

‖ See "Comptes Rendus," 1867.

§ See the Third Report of the Royal Commissionerson the Cattle Plague, and especially the valuable report of Mr. W. Crookes, F.R.S.

diseased cattle contained the germs or sporules of the microscopic animals discovered by Mr. Beale in the blood of such animals; for Mr. Crookes having condensed on cotton wool these germs, and having inoculated the blood of healthy cattle with them, they were at once attacked with the disease. As to the value of carbolic acid for preventing the spread of cholera, among many instances which I could cite, allow me to mention two special instances: First, Dr. Ellis, of Bangor, says:—I have in many instances allowed whole families to return to cottages in which persons had died from cholera, after having had the cottages well washed and cleansed with carbolic acid, and in no case were any persons so allowed to enter such purified dwellings attacked with the disease. My friend, Professor Chandelon, of Liége, has stated to me that out of 135 nurses who were employed to attend upon the cholera patients—and they must have been numerous, for 2,000 died—only one nurse died, but the nurses were washed over and their clothing sprinkled with carbolic acid. In fact the antiseptic properties of carbolic acid are so powerful that 1-1000th, even 1-5000th will prevent the decomposition, fermentation, or putrefaction for months of urine, blood, glue solution, flour, paste, fœces, &c., &c.;* and its vapour alone is sufficient to preserve meat in confined spaces for weeks; and even a little vapour of this useful substance will preserve meat for several days in ordinary atmosphere, and prevent its being fly-blown; lastly, 1-10,000th has been found sufficient to keep sewage sweet, for Dr. Letheby states, in a letter addressed to me, that through the use of such a quantity of carbolic acid in the sewers of London during the existence of cholera last year, the sewers of the City were nearly deodorised. And I am proud to say that the British Government have decided to use exclusively our carbolic acid (as an antiseptic and disinfectant) not only on board Her Majesty's ships, but in other Government departments; and that no other deodorant or disinfectant, such as chlorides of zinc or iron, permanganate of potash, or any disinfecting powder, shall in future be used for such purpose. Although questions of public health are the province of medicine, still permit me to say a few words on the medicinal properties of carbolic acid. This question deserves to be treated thoroughly, for phenic acid is susceptible of so many applications in this direction; its properties are so marked, so evident, and so remarkable, that they cannot be made too public, and it is rendering a service to mankind to make known some of the employments of so valuable a therapeutic agent.

I wish all who are listening to me were medical men, for I could show, by numerous and undeniable facts, the advantage they might derive from pure carbolic or phenic acid, and if my testimony was not sufficient to convince them, I would invoke the authority of men justly esteemed amongst you. I would recall to you the words of the good and learned Gratiolet, and those of Dr. Lemaire, showing that carbolic acid is the most powerful acknowledged means of contending with contagious and pestilential diseases, such as cholera, typhus fever, small-pox, &c.† Maladies of this order are very numerous, but in carbolic acid we find one of the most powerful agents for their prevention, for besides many instances which have been cited to me, I may add that I have often used it in a family in which there were eight or ten children, and that none of the family have suffered from those diseases except those who were attacked previously to the employment of carbolic acid about the dwellings in which such diseases existed. Besides its antiseptic action, the caustic properties of carbolic acid are found useful; most beneficial effects are obtained from it in the treatment of very dangerous and sometimes mortal complaints, such as carbuncle, quinsy, diphtheria, &c., as shown by Dr. T. Turner, of Manchester; and also in less severe affections, such as hæmorrhoids, internal and external fistulas, and other similar complaints. But what must be especially mentioned is the employment of carbolic acid in preserving in a healthy state certain effect. purulent sores, and preventing the repulsive odour which comes from them, an odour which is the symptom of a change in the tissues, and which often presents the greatest danger to the patient. The services which carbolic acid renders to surgery can be judged of by reading several most interesting papers on compound fractures, ulcers, &c., &c., lately published in the *Lancet* by J. Lister, F.R.S.; and allow me to draw your special attention to the following paragraphs which are to be found in his paper published in that journal of the 25th September, 1867:—"The material which I have employed is carbolic or phenic acid, a volatile organic compound, which appears to exercise a peculiarly destructive influence upon low forms of life, and hence is the most powerful antiseptic with which we are at present acquainted. The first class of cases to which I applied it was that of compound fractures, in which the effects of decomposition in the injured part were especially striking and pernicious. The results have been such as to establish conclusively the great principle that all the local inflammatory mischief and general febrile disturbance which follow severe injuries are due to the irritating and poisoning influence of decomposing blood or sloughs. These evils are entirely avoided by the antiseptic treatment, so that limbs which otherwise would be unhesitatingly condemned to amputation may be retained with confidence of the best results. Since the antiseptic treatment has been brought into full operation, and wounds and abscesses no longer poison the atmosphere with putrid exhalations, my wards, though in other respects under precisely the same circumstances as before, have completely changed their character; so that during the last nine months not a single instance of pyæmia, hospital gangrene, or erysipelas has occurred to them." My hearers can also witness the same remarkable results by visiting the two sick wards of Dr. Maisonneuve, at the Hotel Dieu. Further, I must not overlook the valuable application made of it to gangrene in hospitals by the eminent physician, James Paget, Esq.; and lastly, it has been used by many of the most eminent medical men with marked success in those scourges of humanity, phthisis and syphilis.

In agriculture our firm has stimulated the employment of the carbolic acid for the cure of certain diseases very common to sheep—scab, for example. The method of treatment customary in similar cases was very imperfect as well as dangerous, whilst with carbolic acid this malady is cured, and without danger to the animal, by dipping it for a minute, often only for some seconds, in water containing a small quantity of carbolic acid. For this purpose pure acid would be too expensive, and is not used, nor concentrated acid, which ignorant men who have the care of sheep would not know how to use, but by the help of soap an emulsion of carbolic and cresylic acids is made. After having shorn the sheep it is dipped in this mixture; a single immersion in a bath containing 1-60th of it is sufficient to effect a cure. After scab, the foot-rot is one of the worst and most frequent complaints. Carbolic acid is also for that an efficacious remedy. For this a mixture is made of the acid and an adherent and greasy substance, capable of forming a plaster, which is made to adhere to the animal's foot for two or three days, preventing the contact of the air, allowing thereby time for the application to have its effect. But if the flock be numerous, it would take a long time to dress the four feet of each animal one after another; so, to make it more easy, a shallow tray is made of stone—a sort of trough; this is filled with the medicated mixture, and the sheep made to pass through it; their feet being thus impregnated with the required substance. Permit me also to state that cattle cease to be annoyed with flies

* See private reports made by Dr. Allen Miller, F.R.S., and Mr. Crookes to Messrs. F. C. Calvert and Co.

† See Mr. Lemaire's work on Phenic Acid. Paris, 1865.

&c., if washed with this solution, or a weak solution of carbolic acid; and a first-rate salve can be prepared by adding 10 per cent of carbolic acid to butter, or any other fatty matters used for such purpose.

Manufacturers have not yet availed themselves of one tithe of the valuable properties of carbolic acid, and in this direction a new field is open to its use; still I may cite a few instances. The preservation of wood has been already referred to, and thanks to carbolic acid, the great trade in skins and bones from Australia, Monte Video, Buenos Ayres, &c., will ultimately be benefited. Wild animals living there in herds are slaughtered by thousands. Formerly they came to us in a bad state, half putrid, emitting an insupportable odour, and only fit for manure; in this state their price was not more than 150 francs the 1,000 kilogrammes, now, with carbolic acid treatment, they arrive perfectly preserved; they can be employed for all the uses to which green or raw bones are usually applied, and the value of bones is raised as much as from 250 to 300 francs. Hides also often arrive putrid, although they have been dried rapidly in the sun or salted, which latter process, as you are aware, necessitates long and costly manipulations; whilst it is only necessary to immerse them for twenty-four hours in a solution of 2 per cent. of carbolic acid, and dry them in the air, to secure their preservation. It is probable that in a short time the blood, intestines, and other parts of these animals will be, by means of carbolic acid, converted into manure, and imported into this country. In England carbolic acid is used in the preservation of guts at the gut-works, for keeping anatomical preparations, and the preservation of all animal matter. Carbolic acid is also utilized in preventing the decomposition of the various albumen, flour, and starch thickeners used in calico printing, as well as gelatine or bone size, employed for sizing fustians and other cotton goods.

One of the most interesting chapters in the history of carbolic acid is certainly that which relates to the production of colouring materials; they alone enter into comparison with those derived from aniline, and often enter into successful rivalry with them. Amongst the colouring matters derived from carbolic acid, the most important is, without fear of contradiction, picric acid.

The discovery of this acid dates back to a distant period; it was studied by Welter, and was called Welter's bitter. But it was my illustrious master, M. Chevreul, who in 1807 discovered the real chemical composition of picric acid, and who demonstrated that picric acid was often produced when organic matters were acted upon by nitric acid. Further, M. Chevreul discovered in the products of the oxidation of organic substances through nitric acid two different compounds, which he called *amer au minima* and *amer au maxima*, the latter being picric acid. This acid was again examined by Laurent in 1841, when he demonstrated that the true generator of picric acid was phenic acid; that in the action of nitric acid on the latter it formed three nitrogenated compounds, mononitrophenic acid, binitrophenic acid, trinitrophenic acid, the latter being also picric acid.

These interesting results of Laurent would perhaps have remained for a long time without any commercial value, if picric acid had not been applied to dyeing, in 1847, by M. Guinon, sen., of Lyons. Since then the use of this acid, producing magnificent yellows, has been much extended, and what has contributed to its employment is that, conjointly with indigo, it gives ordinary greens, or of *vert Lamière* with Prussian blue, so that its consumption may be valued at from 80 to 100,000 lbs. annually; our firm alone produces more than 300 lbs. weekly; and when it is considered that 1 lb. of picric acid dyes to an intense shade 70 to 100 lbs. of silk, or 40 to 50 lbs. of wool, the enormous quantity of textile materials dyed by this single product may be appreciated.

The processes followed for the preparation of picric acid are still those which Laurent indicated in 1841; but instead of using carbolic acid loaded with the heavy oils of tar, as M. Guinon had done, I sought to diminish the quantity of nitric acid, employed in mere waste, on the heavy oils of tar, which were then mixed with carbolic acid, and I am glad to say that I succeeded in doing so in 1849 by employing carbolic acid containing only some of its liquid homologues. In 1856, M. Bobœuf took out a patent in France for making picric from carbolic acid. But picric acid was still at a high price, and it is only since our firm has manufactured cheap carbolic acid that picric acid can be produced free of resinous materials which prevent its purification and its being sold at a low price; in fact, owing to our pure carbolic acid, picric acid is now obtained chemically pure; this product, which was sold some years since at 15s. to 20s. per lb., is now sold at the rate of 3s. Further, I may add that to apply it in a quick and economical manner it is desirable to add to the dye bath a small proportion of sulphuric acid; this method of manipulation, which is not generally known, is very important, for it is only in this way that the textile materials can be readily dyed and the baths exhausted.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

ACADEMY OF SCIENCES.

December 9, 1867.

Stellar Spectra—Ozonometry—Dialysis of Induction Currents—Electrolysis of Organic Salts.

This day's meeting of the Academy was opened with the announcement of the death of M. Flourens, the perpetual secretary.

Father Secchi contributed a note on the spectra of stars and meteors.

An interesting memoir was brought forward by MM. Berigny and Salleron, in the form of a reply to a note recently addressed to the Academy by M. Pœy, on the ozonoscopic colourations produced in iodide of potassium and starch, and on the ozonometric scale of M. Berigny.

M. Pœy's note treated of two distinct questions—(1) The various colourations taken by the test-paper under different atmospheric conditions; (2) the insufficiency of M. Berigny's scale.

Without affirming the reaction to be irreproachable, they consider some of the sources of error to proceed from the mode of experimentation which has been in use up to the present time. When the test-paper is exposed for twelve hours in an atmosphere charged with ozone, the reagents undergo complicated decompositions. MM. Berigny and Salleron believe it would be otherwise if the method of making the experiment were modified; they describe at some length a process by which they hope to eliminate sources of error.

One point to which attention is drawn, is the immersion of the test-paper in distilled water immediately a definite tint is reached. When the paper is exposed in an atmosphere containing much ozone the reagent mixture is rapidly decomposed, and if not plunged into water until some hours afterward the iodide of starch possibly undergoes alteration, and does not then produce normal tints; this is especially the case when the air is very moist. This perturbing cause, however, is inherent and is recognised.

With regard to the ozonometric scale, they propose some changes—instead of determining the amount of ozone from the colour the test-paper acquires during twelve hours, they prefer to measure the time necessary for the paper to be exposed to produce a determinate shade of colour. Suppose on a certain day it requires an hour's exposure to obtain the tint, and the next day two hours' exposure is necessary, evidently only half as much ozone is present on the second day as there was the first day. Thus the

quantity of ozone may be said to be inversely proportional to the duration of exposure.

By a mechanical contrivance a band of test paper, twelve centimetres in length, is moved at a definite rate from protection to exposure to the action of the atmosphere. How the test paper is protected from the action of the atmosphere for some hours in the instrument was not explained, and this to your correspondent seems the most difficult and at the same time the most essential point to secure. However, if the band be made to move at the rate of one centimetre per hour, at the end of twelve hours a band of paper twelve centimetres in length will have passed ; at one end of it a centimetre will have been exposed for twelve hours, the next for eleven, and so on down to one. The band of paper having thus passed the instrument, it is plunged into distilled water, and colours varying between white and violet are displayed. It is now only necessary to compare this with the standard colour, and to measure the position on the band where the tints are identical. It is then known how many hours it has been exposed.

They choose a faint tint as the standard, as this will be applicable in all latitudes, the fourth tone of the first violet in M. Chevreul's chromatic circles.

A physical paper on the dialysis of induction currents by M. Bouchotte was presented by M. Becquerel. At the same meeting there was also a paper on the electrolysis of acetic acid by M. Bourgoin. In a former paper the author advanced a theory referring to the electrolysis of organic acids and salts generally. In this he applies it to acetic acid, and gives the detail, of experiments.

The apparatus he arranged was the following :—A tube closed at the upper extremity with a caoutchouc cap, and at the lower extremity closed with the exception of a very small hole. Through the cap passes a small syphon tube almost capillary, as well as a platinum wire, which terminating inside the tube in a plate of that metal, forms one electrode. This tube is encircled by a larger one of such capacity, that when the disengaged gas in the interior exerts a pressure of 4 centimetres, the volume of solution in each tube shall be the same. In the annular space formed by these tubes the other electrode is plunged. Experiments were made with a neutral solution of acetate of potash which had been analysed: after submitntng it for six hours to the electrolysing action of four elements, a portion of the liquid was drawn off from the neighbourhood of each pole and analysed. The conclusions arrived at are that the decomposition into carbonic acid and carburetted hydrogen is almost *nil*, and that the greatest loss is at the positive pole. Daniell and Miller, M. Bourgoin remarked in his paper, found in the electrolysis of inorganic compounds the negative pole to be that at which the greatest loss occurred. In organic chemistry the only fact known *àpropos* of the subject is the observation due to M. Hittorf, who found in the electrolysis of acetate of silver the greatest loss to proceed from the positive pole.

His observation is therefore confirmed by these more recent experiments.

The author sums up the result of his experiments as follows:—

1. The current acts on acetate of potassium as on a mineral substance.

2. In a moderately alkaline solution the oxygen reacts on the elements of the anhydrous acid, and gives rise to a normal oxidation, whence results carbonic acid and hydride of ethylen :—

$$C_8H_6O_6+O_2=2C_2O_4+C_4H_6.$$

3. A certain quantity of acid is totally consumed under the influence of oxygen furnished either by the salt or by the alkaline water.

4. The two poles suffer unequal losses. Almost the whole of the salt which disappears belongs to the positive pole.

5. The current acts on the free acetic acid in the same manner as sulphuric acid ; it concentrates the acid at the positive pole.

The gas evolved during the electrolysis was found to be chiefly composed of oxygen, with some carbonic acid, and a little carbonic oxide. Acetate of potassium and an alkali in equivalent proportions evolved at the positive pole only oxygen. When the amount of alkali was increased, the same result was obtained, but a concentrated solution of 2 equivalents of acetate of potassium and 1 of alkali yielded oxygen, carbonic acid, carbonic oxide, and carburetted hydrogen.

M. Kolb has expressed the opinion that acetic ether and possibly also a small quantity of methylic ether might be formed. M. Bourgoin observed no formation of these products.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPODENT.).

PARIS, DEC. 18, 1867.

Demonstration of Fact that Electricity will not pass through a Vacuum —Electrolysis of Salts—Colliery Explosion—Construction of Roofs —New Paint for Houses.

MM. ALVERGNIAT, FRERES, have contrived a new apparatus for demonstrating the fact that the electric spark does not pass through a perfect vacuum. They create a nearly absolute vacuum by means of a mercurial pneumatic machine in the tube which serves for the experiment; this contains two platinum wires, placed at a distance of two millimetres one from the other. Half an hour is sufficient to obtain the necessary degree. At this moment they heat the tube to dull redness, either over charcoal or, more conveniently, by the special lamp employed by M. Berthelot for organic analyses; when the tube arrives at a dull red, the vacuum is continued to be made, and the electric spark is passed until it ceases to pass through the interior of the tube. It is then hermetically sealed, and the tube is separated from the machine.

In a tube thus prepared, in spite of the slight distance between the two platina points (two millimetres), electricity absolutely ceases to pass.

The above gentlemen now have apparatus at the disposition of professors who would wish to show that electricity does not pass through a perfect vacuum.

M. Bourgoin has published a memoir on the electrolysis of organic acids and their salts. He has found by experiment that the action of the electric fluid is nothing in reality than a fundamental action on all acids and salts, whether mineral or organic; it separates the basic element, which goes to the negative pole, while the elements of anhydrous acid and oxygen, which answer to basic hydrogen or to metal, fly to the positive pole. Such is the fundamental action of the electric current.

The first volume of the Abbé Moigno's "*Lectures on Analytic Mechanics*" (statical part) has just been published. They are based upon the method of Augustin Cauchy, and are extended to the most recent operations of modern times. This work is in 8vo, consisting of 767 pages, and two well-executed copper en-gravings. Three other volumes or parts are to follow, viz.— Dynamics, Industrial Statics, and Industrial Mechanics.

MM. Sainte Claire-Deville and Pasteur have been named Professors of Chemistry in the Faculty of Sciences of Paris, in the place of MM. Dumas and Balard.

M. Sappey has been appointed Professor of Anatomy of the Faculty of Medicine of Paris, in the room of M. Tarpevay. M. Volneuil has been named Professor of Surgical Pathology at the same Faculty, in place of M. Richet. M. Moris is appointed Professor of Anatomy at the Faculty of Medicine of Strasburg.

We have the sad task of recording a fearful colliery explosion in France. On the 12th instant, at 11 a.m., a fire-damp explosion took place, accompanied with the partial falling in of the pit at No. 5 shaft in the Blanzy

mine (Soane et Loire). Eighty bodies have been recovered from the ruins. These melancholy tidings afflict us the more, as M. Chagot, the superintendent, and his co-operators were continually searching for the best means of avoiding these dreadful accidents. The first steps taken by them were the purchase of the excellent apparatus of M. Ansell, which, unfortunately, was not placed throughout the pit. On this occasion we seriously enjoin M. Guen, of Valenciennes, to carry out as soon as possible the benevolent project of M. Dubrunfaut, who has generously offered a reward of £4,000 and a series of graduated premiums, to be awarded to the inventor of a system which will resolve in the most complete manner the problem of security against fire-damp, or to those who give a partial solution of this vital question. To retard any longer this necessary organisation, and, on the part of coal-miniug companies, to defer any longer to answer to the appeal of M. Dubrunfaut, who put down his name for £4,000, would be a great mistake, if not a crime. Our friend, M. Ansell, whose apparatus is constructed in France by M. Salleron, 24, Rue Pavée, Paris, is prepared to make all the experiments and installations of his instrument that may be required, on demand.

The materials with which roofs are generally covered should be paid special attention to by insurance companies. The 29th of last November, at 1 p.m., a violent fire broke out in a hay and corn store, No. 25, Rue du Rocher; in spite of all endeavours, the forage and the premises were rapidly destroyed. The building was roofed with *tiles*. The next day another fire broke out on the Quai St Cloud, in a house roofed with slates. It commenced in the staircase, and so rapid was the progress of the flames that an English family, inhabiting the house, was obliged to jump out of window. It seems that the principal cause of the rapidity of the spreading of the fire in these cases was principally due to the formation of currents of air through the joints of the roof. Experiments were made by M. Maillard, No. 28, Rue Jean Gougon, in the quarter of the Champs Elysées, which proved that his new substance, mineral carton, was much safer than either tiles or slates or zinc in case of fire. Models on a large scale having been erected in the Avenue Montaigne, they were filled with combustible matter which was set on fire. The zinc roof fell in in 7 minutes, the tile roof in 17 minutes, while that covered with mineral carton, after 40 minutes exposure to flame, was sufficiently strong to bear the weight of a man; the reason of this is that the mineral carton prevents any possible ascensional current of air, without which timber will not burn, the effect being only the slow charring of the beams.

A new preparation of house paint has been invented by M. Hugoulin, principal chemist to the Imperial Navy, by which one can prepare, in a few hours, as much paint as is required, without any other utensils than simple small tubs of metal or wood of sufficient capacity. The best paints usually employed in house painting, and which preserve best the wood, have for bases white lead, minium, oxides of zinc, and lamp black. They are not, as in other paints, simple mixtures of drying oil and mineral substances in powder, but intimately blended compounds, in which the elements are combined without chemical double decomposition.

To demonstrate this, the inventor forms, in any vessel, a liquid paste, perfectly homogeneous, with water and a certain quantity in powder of the substances indicated in the following table:—

For 1000 grammes of zinc white we can employ	300 or 350 or even 400	grammes.
For 1000 grm. of grey oxide of zinc	150 to 180	,,
,, white lead	150 to 180	,,
,, red lead	50 to 60	,,
,, lamp black	1000 (thereabouts).	

In this mixture the necessary quantity of linseed oil is added, in order to form a body colour worked up by the ordinary means.

F. Moigno.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Naphtalene, Action of Oxidising Agents on.—F. Lossen. Naphtalene when treated with a boiling solution of potassic permanganate is oxidised to carbonic anhydride and phtalic acid. Phtalic acid is also formed, besides a red resinous body, by the action of potassic bichromate and sulphuric acid, or manganic peroxide and sulphuric acid; in the latter case one of the products of oxidation is dinaphtyl, formed according to the following equation:—

$$2\left\{\begin{matrix}C_{10}H_7\\H\end{matrix}\right\} + O = \left\{\begin{matrix}C_{10}H_7\\C_{10}H_7\end{matrix}\right\} + H_2O$$

Dinaphtyl is a white, crystalline body, which dissolves readily in ether or carbonic disulphide, less in alcohol or benzol, fuses at 150°C. It has been converted into 1. Dibromdinaphtyl, $C_{20}H_{12}Br_2$, soluble in benzol, from which it crystallises well, very readily soluble in a mixture of alcohol, ether, and carbonic disulphide, and fusing at 115°. 2. Hexabromdinaphtyl, $C_{20}H_8Br_6$, a yellowish resinous mass, soluble in ether; sodium amalgam re-substitutes hydrogen with formation of dinaphtyl. 3. Hexachlordinaphtyl $C_{20}H_8Cl_6$, resembles closely the corresponding bromo-compound. 4. Tetranitrodinaphtyl $C_{20}H_{10}(NO_2)_4$, an orange-coloured, resinous substance, soluble in alcohol. This body, when treated with tin and chlorhydric acid, yields small quantities of a base of very unstable character.

The resinous matter which is obtained by oxidising naphtalene with potassic bichromate and sulphuric acid, or more readily with manganic peroxide and sulphuric acid, contains an amorphous acid of the composition $C_{20}H_{14}O_4$.—(*Zeitschr. Chem* N.F. iii, 419.)

Substituted Alcohols and Aldehydes.—F. Beilstein and A. Kuhlberg. The following compounds were prepared: Paranitrobenzylic acetate, $C_7H_6(NO_2).C_2H_3O_2$, by adding benzylic acetate to well-cooled, strongest nitric acid, and precipitating with iced water; yellowish needles, fusing at 78°C, readily soluble in hot alcohol. Paranitrobenzylic alcohol, $C_7H_7(NO_2)O$, by heating the former compound with aqueous ammonia in sealed tubes to 100°; white crystals, fusing at 93°, soluble in hot water and ammonia. Paranitrobenzylic oxalate $[C_7H_6(NO_2)]_2.C_2O_4$, by dissolving benzylic oxalate in strong nitric acid. Like the acetate it gives the alcohol on being heated with ammonia. Benzylic oxalate, $(C_7H_7)C_2.O_4$, by the action of chlorbenzyl upon argentic oxalate; crystallises like naphtalene, fuses at 80·5°, insoluble in water, soluble in hot alcohol. Oxidising agents convert the alcohol and all its ethers into paranitrobenzoic acid. Parachlorbenzylic alcohol, C_7H_7ClO, by heating chlorbenzylic acetate with ammonia to 160°; scarcely soluble in boiling water, fusing at 66°, is converted into parachlortoluylic acid, $C_7H_5ClO_2$, on being treated with oxidising agents. Dichlorbenzylic alcohol, $C_7H_6Cl_2O$, by heating in a sealed tube dichlorbenzylic acetate (obtained by the action of alcoholic potassic acetate on dichlorbenzylic chloride, $C_6H_3Cl_2(CH_2Cl)$) with ammonia. Parachlorbenzoic aldehyde, $C_7H_4ClO.H$, by boiling chlorbenzylic chloride, $C_6H_4Cl(CH_2Cl)$ with an aqueous solution of plumbic nitrate, combining the insoluble oil with sodic bisulphite, and boiling with sodic hydrate. The aldehyde absorbs oxygen, and is converted into parachlorbenzoic acid.—*Zeitschr. Chem.*, N.F. iii., 467.

Paraffin Lamps.—We learn from the *Norfolk* (U.S.A.) *Journal* that it has been found that the light of coal-oil lamps is greatly improved by adding to the oil one-fourth its weight of common salt. It makes the light much more brilliant and clear, keeps the wick clean, and prevents smoking.

CORRESPONDENCE.

THE DECLINE OF ENGLISH MANUFACTURES.

To the Editor of the Chemical News.

Sir,—The relative decline of the industrial arts in England has been ascribed, with more or less probability, to a variety of causes. As far as chemical manufactures are concerned, "strikes" and trades' unions can have had no injurious influence. Neither can excessive wages, since at a chemical works labour bears a lower proportion to the gross returns than probably in any other branch.

As far as opportunity has enabled me to judge, the main root of the evil is the defective education both of managers and foremen, and of common workmen. That the Englishman is naturally inferior in intellect to the German or the Frenchman I deny, but his faculties are not systematically developed; and the school system of this country leaves him in such a state of ignorance, that if you speak to him of "science," he actually thinks you mean pugilism. To expect men thus dragged up to compete with such as have been trained in the schools of the leading continental nations, is as rational as to pit a regiment armed with the old flint-lock musket against one equipped with the needle-gun or the Chassepot. A fact mentioned some time back in the Chemical News throws a strong light on the inferiority of this country. The inspectorship of high schools in France was held till lately by the celebrated chemist Dumas. Any similar office in England would be committed not to a man of science, but to a clergyman, a briefless barrister, or a half-pay officer.

Men whose powers of observation have never been cultivated cannot execute the most simple process without mistakes. In proof of this I cite two facts which have lately come under my own observation. A man employed at a large dye-works was sent to the warehouse for a bucket of extract of quercitron-bark. He returned with his pail full of methylated alcohol!—a clear, colourless, transparent fluid, in place of one deep, brown, turbid, and opaque. Another, sent for archil paste, brought a cargo of grease used along with soda for cleansing the goods previous to being dyed. Both the men had worked for years at the establishment, and had had every opportunity of becoming familiar with the articles in question. Such men necessarily occasion their employer waste and loss incalculable. They are a perpetual stumbling-block in the way of the inventor, who is frequently told by practical men: "the process is all right in your hands, but how am I to get my careless men to work it?"

We can maintain supremacy in manufactures only on condition of supremacy in science; and if we are unable or unwilling to arrange our national system of education accordingly, we must be content to fall into the rear.—I am, &c., W.

MISCELLANEOUS.

Storage of Nitroglycerine.—Another disastrous accident has happened with this recently introduced blasting oil. Unless means are taken by the manufacturers to prevent explosions causing such lamentable results as that which occurred at Newcastle on Tuesday, a valuable blasting agent will be lost to miners and quarriers. If this be the case, however, the manufacturers of it will have themselves to blame, for explosions of nitroglycerine during transport or storage ought to be unknown. Nitroglycerine dissolved in two or three times its bulk of methylated spirit is quite inexplosive, and when required for use, the addition of water will precipitate the oil, the layer of water and spirit merely requiring decanting off. The nitroglycerine separated in this way possesses explosive properties quite as active as the original oil, which indeed is frequently rather improved than otherwise by the treatment. The process we have described is sometimes used. At Newcastle a part of one canister was found after the explosion marked "safety solution of nitroglycerine in wood naphtha." It is, however, quite certain that there must have been a quantity of oil present either entirely untreated, or treated with an insufficient quantity of the protecting fluid. It should be remembered that nitroglycerine dissolved in a small quantity of methylated spirit or of wood naphtha in warm weather might crystallise out in winter when the temperature approaches the freezing point of water. Probably this is what occurred. Shipping agents and railway companies should refuse to receive nitroglycerine unless protected in the manner already indicated.

Dinner of the Scientific and Manufacturing Chemists of Glasgow.—On Thursday evening, about fifty gentlemen connected with this large and important branch of industry in Glasgow and neighbourhood met at dinner in the Victoria Hotel. The meeting was intended as a preliminary to the formation of a Chemical Society in that city. Mr. E. C. C. Stanford, F.C.S., presided, and Mr. Whitelaw discharged the duties of croupier. Among the company we noticed Professor Anderson, F.R.S., Dr. Wallace, F.C.S., Mr. Leisler, Mr. Townsend, Mr. J. J. Turnbull, Mr. J. N. Cuthbertson, Mr. Galbraith, Mr. Middleton, and others. Mr. Stanford read a note from Professor Penny, stating that he had shortly before received a telegram calling him to Edinburgh, to visit a friend seriously ill, and expressing great regret at his unavoidable absence. After the usual loyal and patriotic toasts, the Chairman, after some introductory remarks, said—The tendency of chemistry appears to be synthetical. The chemist used to be described as a man who could pull anything to pieces and put nothing together—who was troubled with a large bump of destructiveness and a small one of constructiveness. Now the time appears less distant when we shall build up our organic compounds from their inorganic constituents; manufacturing chemistry is following—we are turning to the earth already for many materials which were formerly organic. Some of these changes will at once occur to you. Our sources of potash have been suddenly and enormously aided by the discovery of a large evaporated bed at Strasfurt; and that mine, so admirably worked by Mr. Townsend, has reduced the price of potash to a third its former value. Liebig accused us in passionate language of "turning up the battlefields of Leipsic, Waterloo, and the Crimea for bones; from the catacombs of Sicily we carried away the skeletons of many generations." Speaking of England in 1863, he says—"Annually she removes from the shores of other countries to her own the manurial equivalent of 3¼ millions of men, which she squanders down her sewers to the sea. Like a vampire she hangs upon the neck of Europe, and sucks the heart blood from nations." Almost while he was writing this we discovered coprolites in England, and exported phosphates to Germany; and now most of our phosphates are mineral. Guano will doubtless also give way to salts of ammonia and nitrate of soda from the earth. The time is probably not far distant when our large Cinchona plantations will be rendered useless by the introduction of artificial quinine. And a change may come over our Turkey-red makers by the production of artificial guarancin. Does any one think this visionary? Let me remind him that not long ago we imported nearly all our dyes, and now we are the largest colour exporters. Our dyes are dug from the earth. Can anything be more wonderful than extracting from coal the sun's light of a bygone age, and splitting it up into all the colours of the rainbow? or, as in Mr. Young's discovery, using it in the form of paraffin once more to light our rooms? What would have been said of any one ten years ago who spoke of analysing the atmosphere of

the sun? We must be prepared for startling discoveries in this glorious science. Whatever I have said generally of manufacturers applies more particularly to Glasgow. This city has great reason to be proud of its chemical factories—nearly every known branch is here represented. Long before the stranger who approaches Glasgow sees the flames of her forges, or hears the sound of her hammers, his attention must be arrested by her tall chimney shafts; the masts to which her chemical flag is nailed, and her manufacturers' challenge held high before the world. If a factory can be measured by its height, one of these stands distinguished and pre-eminent. Humboldt called chemistry "the Egyptian art," and unless it should return to that country, and one of the pyramids be converted so that it "draws" even better than at present, our friend Mr. Townsend will still reign without a rival, and never be able to compete with any one his own size. Glasgow is no less distinguished for its scientific chemists—Thompson, Ure, and a long list of names form a brilliant scroll. Here, then, of all cities, the scientific stranger will expect to find one of the best chemical societies in the kingdom. Gentlemen, you and I know how much he would be disappointed. We are all to blame, but let us now make a move. This is an opportune time. The Government is at last awakened to the necessity of scientific education. The British Association, the Society of Arts, the Paris Exhibition, have all joined in one cry, which must be heard—scientific education for our people. Let us commence by forming a section of the Philosophical Society, where chemical subjects can be brought forward in a crude state and discussed. Scientific chemists and manufacturers are both required to work out some purely scientific subjects from which they would derive mutual profit. Let it not be said that the birth-place of Thompson, Graham, and Stenhouse cannot keep up a chemical society. If we do not make an effort now the chemical world will move on, and we shall be left behind." The following toasts were also given :—"Scientific Chemists," by the croupier, responded to by Professor Anderson; "Manufacturing Chemists," by Dr. Wallace, responded to by Mr. Galbraith; "Foreign Chemists," by Mr. Sutherland, responded to by Dr. Mertz; "Chemical Brokers," by Mr. Turnbull, responded to by Mr. Leisler. Several other toasts followed, and a very agreeable evening was spent.

Obituary.—Mr. Warington, F.R.S., the distinguished chemist, died on November 12th, at Budleigh, Salterton, Devon. So many benefits have been conferred upon chemists by Mr. Warrington's zeal, that his decease will be a matter of general regret in the profession. His life seems to have been pre-eminently a life of public activity. He may be said to have founded the Chemical Society; upon its establishment he became secretary, a post he retained for many years. He also obtained the same responsible position in the Society which has rendered so much service to chemists in publishing a translation of Gmelin's Handbook—the Cavendish Society. These are not the only public positions in which he has figured; he was a juror of the Chemical Section of the International Exhibition of 1862, co-editor (Dr. Redwood being the other) of the British Pharmacopœia, 1867, besides having a hand in the production of some other works on pharmacy and allied matters. Mr. Warington has undertaken many researches. A vast number of papers were published by him on various subjects in chemistry and pharmacy; some of these are to be found in the *Philosophical Magazine*, but the majority in the *Chemical Gazette*. We append a list of some of the more important. On improvements in the operation of tanning; on refining gold; on the formation of Prussian blue on the surface of gravel; on the action of weak acids on vessels plated by the electrotype process; on the action of alkalies on wax; on chemical symbols; on a curious change in the molecular structure of silver; on molecular changes in solid bodies; on the green glass of commerce; on some properties of animal charcoal; on the preservation of animal and vegetable substances; on chromic acid; a process for estimating the value of the materials used in tanning; on the production of coloured films by electro-chemical influence and by heat; on a new yellow dyeing agent; on the production of boracic acid and ammonia by volcanic action; on biniodide of mercury; on the determination of phosphoric acid by magnesia. Mr. Warington held the office of chemical operator at the Society of Apothecaries for upwards of twenty years. He retired from the profession last year.

Dr. Daubeny.—With deep regret we announce the death of Dr. Daubeny, Professor of Botany, Oxford, whose contributions to the cause of science have often appeared in our columns. He was a son of the Rev. James Daubeny, Rector of Stratton, and was born in 1795. He was educated at Magdalen College, Oxford, where, in 1814, he took the degree of B.A., when he was second class in classics. In the following year he gained the Chancellor's prize for an essay. He afterwards obtained a lay fellowship at Magdalen, and applied himself to the study of medicine, taking the degree of M.D. In 1822 he was elected to the Professorship of Chemistry, and in March of the same year he was elected a Fellow of the Royal Society. In 1829 he entirely relinquished the practice of his profession, and devoted himself to the study of the physical sciences. During the year 1834 he was elected to the Professorship of Botany, and he was also curator of the Botanical Gardens at Oxford. In 1841 Dr. Daubeny became a fellow of the Chemical Society, of which at the time of his death he was Vice-President, having previously filled the office of President. Dr. Daubeny has written several works, among them may be noticed "A Description of Active and Extinct Volcanoes;" "An Introduction to the Atomic Theory;" "Lectures on Roman Agriculture," &c. Amongst his contributions to the Chemical Society may be mentioned a paper on the power possessed by the roots of plants of rejecting poisons, and also one on "Ozone," which embodied the results of an extensive series of experiments and meteorological observations made at Torquay and Oxford. He died at the Botanical Gardens, Oxford, on December 12.

CONTEMPORARY SCIENTIFIC PRESS.

(Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the "Chemical News.")

Journal des Fabricants de Papier.

August 1, 1867.

E. Bourdilliat, "On Testing the Chemical Products used in Paper Making. (Continuation.) Prussian Blue." Z. Orioli and Henry, "An Agitator for Preparing Solutions of Chloride of Lime." C. Orts-Vandenberghen, "A Process for Rendering Canvas, Tissues, Paper, Pasteboard, &c., waterproof." A. Swan, "An Improved Apparatus for Evaporating and Recovering Spent Lyes." B. C. Tilgman, "An Improved Method of Treating Vegetable Substances for the Manufacture of Paper Pulp."

August 15.

E. Bourdilliat, On Testing the Chemical Products used in Paper Making. (Continuation.) Acetate of Iron, Sulphate of Copper, Acetate of Copper." J. L. Brebant, "On the Use of Waste Fabrics for the Manufacture of Pasteboard."

Archives des Sciences.

August 25, 1867.

C. Marignac "On the Separation of Niobic Acid from Titanic Acid, and on an Analysis of Æschynite."

Kunst und Gewerbeblatt.

July, 1867.

F. Moigno, "On an Animal Charcoal Filter on H. Danchell's principle, manufactured by the London Water Purifying Company." T. Wegler, "On Disinfection." "On the Manufacture of Plastic Charcoal." Hailer, "On the Impurities of the Coals of Upper Bavaria." R. Wagner, "On the Detection of Cotton in Silk Yarn and Fabrics." "On Mandarin Yellow, a new Colouring Matter prepared from the Refuse of Cider Making." E. Dietrich, "Note on the Preparation of Indigo Carmine."

L'Invention.
September, 1867.

J. GREEN. "On the Disinfection of Petroleum." SALVET, "On Brianchon's Pearl Glaze for Glass and Porcelain.

Journal für Praktische Chemie.
August, 1867.

C. MARIGNAC, "On R. Hermann's Researches on the Atomic Weight of Tantalium, Niobium, and Ilmenium." A. KENNGOTT, "On the Alkaline Reaction of some Minerals."

Bulletin de la Société d'Encouragement.
July. 1867.

F. C. CALVERT, 'On Phenic Acid and its Properties." TESSIE DU MOTHAY, "A Method of Preparing Oxygen and Ozone from the Alkaline Permanganates." "On the Preparation of Oxygenized Water." S. HUNT, "On some new Methods of Smelting Ores of Use in New England." BALLARD, "On the Use of Silicic Acid for the Manufacture of Soap and for other Purposes." PAVEN, "On the Manufacture of German Yeast." DUMAS, "On the Silkworm Disease." PASTEUR, "On the Silkworm Disease." LENOIR, "An Improved Writing Telegraph." TRESCA, "On the Advantages of Armstrong's Accumulator for Hydraulic Apparatus."

Comptes Rendus.
September, 23, 1867.

F. LUCAS, "On the Limits of Visibility of the Electric and other Light." J. L. SORET, "On the Intensity of Solar Radiation." J. KOLB, "Researches on Chloride of Lime."

Bulletin de la Societe Chimique de Paris.
July, 1867.

LECOQ DE BOISBAUDRAN, "Some Experiments on Supersaturation." C. LAUTH and A. OPPENHEIM, "On the Action of the Chlorides of Terebenthine on Aniline and Rosaniline." P. P. DEHERAIN, "On the Use of Potash Salts as Manure."

August.

LECOQ DE BOISBAUDRAN, "On the Supersaturation of Saline Solutions." G. LEMOINE, "On the Transformation of Red Phosphorus into Common Phosphorus." BOURGOIN, "On Organic Radicals." P. P. DEHERAIN, "On the Use of Potash Salts as Manure."

NOTES AND QUERIES.

Lime Soap.—Can any of your friends tell me how to decompose lime soap, completely and quickly? The hydrochloric and sulphuric acid methods require too much boiling to pay.—A. B. E.

Bone Boiling.—Your correspondent, "Oss," making inquiry as to means to abate the nuisance or smell of bone boiling, or rendering fats, as well as other kindred points, can receive the desired information by addressing H. S. B., Box 4968, P.O., New York City.—H. S. BRADFORD.

The Bichromate Battery.—In reply to "Clericus," I frequently use the bichromate battery with a Ruhmkorff's coil. Its action is considered as "intense" as a "Grove's," but it is less constant. This defect is to a great extent remedied by the usual form in which it is constructed, viz., with a means of raising the zinc out of the solution whenever it is required to stop the current, thus economising its power. The zinc should be amalgamated, and the cold saturated bichromate solution mixed with a twelfth part by measure of sulphuric acid. One great advantage of this battery is that it gives off no fumes. —F. BADEN BENGER.

Extraction of Oil.—Dyeing Turkey Red.—Can any of your readers give me information relating to the use of bisulphide of carbon in extracting oil from liquors with which it is mixed, such as a solution of olive oil, pearl-ash ley, and water, and if an apparatus for this purpose would be expensive? Also, I should like to know if hyposulphite of alumina is at present in use as a mordant for Turkey-red dyeing, and if any of your numerous correspondents can supply me with a good practical process for dyeing Turkey-reds, both in cloths and yarns, similar to what is at present pursued in some of the large establishments in Lancashire.—E.

China Clay.—I deal largely in china clay, and find curious differences in the purity of certain lots—for instance, three months ago I delivered a maker of sulphate of alumina fifty tons, about which no fault was found; but six weeks after, when the remainder of the cargo came to be delivered, it was found to give out sulphurous acid largely during calcination, and to yield, moreover, a bad colour in the manufactured article. Now the question arises, can this clay, lying as it did in sheds at Runcorn, absorb sulphurous acid from the atmosphere, which may escape from some of the large chemical works in immediate neighbourhood? I can give no other reason for the impurity. —ENQUIRER.

Receipt for Preparing Blue-black Writing Ink, which also serves well for Copying Ink.—Take of blue Aleppo galls five ounces and a half; powdered cloves, quarter of an ounce; purified sulphate of iron, an ounce and a half; sulphate of indigo (in the form of a thin paste), an ounce and a half; pure sulphuric acid, thirty-five minims; cold rain water forty ounces. Digest the galls when bruised with the cloves in twenty ounces of the water for one week, then pour off the liquor into another bottle and cork it. Then pour ten ounces more of the water on the galls and digest four days. Then pour liquor as before into bottle. Pour then the remaining ten ounces of the water on the galls, and digest four days. Then pour off liquor into bottle, and filter through French filtering paper, wringing out hard the refuse of the galls in a strong clean linen or cloth into the filter, so that nothing be lost. Add now the iron, and dissolve and filter through paper. Then the acid, and shake. Then the indigo, and thoroughly mix it, and pass the whole through filtering-paper. Care must be observed that the indigo be mild, and not contain too much free acid.—J. H.

Bleaching Palm Oil.—Your correspondent, Mr. George Johnson, has failed to bleach palm oil from three causes. He has, first, the water condensed from the steam. 2. The dreg is left in the oil; and 3. He is too sparing of his materials. Let him try the following: "Boil the palm oil, either with steam, or if in a pan with a fire under it, add half a hundred-weight of water to the oil in the pan before the fire is put to it, allow the whole to settle till next day, draw off the pure clear oil only into a clean dry palm-oil cask standing on end with the head out. For ten hundred weight, fourteen pounds bichrome, to which add as much boiling hot water as will dissolve two-thirds of the chrome; after a little stirring add to this thirty-five pounds of muriatic acid which will dissolve the rest, making a strong solution; have ready fifteen or twenty pounds of concentrated sulphuric acid, add the acid chrome solution to the oil, and stir for a few seconds, while stirring begin pouring the sulphuric acid, not too slow, until a strong dark green appears, then stop pouring the acid, stir for a second or two, and add 20 gallons boiling water, a little more stirring and the process is finished. About 7 or 8 lbs. of sulphuric acid should bring out the green. With all the materials ready at hand, the process should be finished in 3 minutes. These proportions, especially the acids, are in excess, but a little practice will enable G.J. to reduce the quantities. The agitation should be vigorous, not round about but from the bottom to the top, so as always to bring up the chemicals through the oil. P.S.—Don't bother much about the temperature.—G. H. W

Water for Steam-boilers.—In reply to E. S. I., I beg to give the following information:—Your correspondent will hardly meet with a book on the subject alluded to, since it would be next to impossible to meet every special case. There exists a German work, the title of which is "Der Fuhrer des Machinisten," bei C. F. Scholl, Civil Ingenieur, published at Brunswick by Vieweg and Sons, 6th edition, 1864. This thoroughly practical book contains a large amount of information which would be vainly looked for in books on steam engines. As regards the incrustations in boilers, it is not only the greater or less amount of mineral matters kept in solution by the water supplied to the steam-boilers which is to be considered, but also the presence of the steam, consequently the temperature to which the water is heated, the mode of supplying water to the boilers, and the place at which the feed pipes enter the same. As a general rule, a hard strongly adhesive incrustation is more due to the sulphate of lime than to the carbonate of lime. The latter, when no sulphate at all is also at the same time met with in the feed water, leaves a muddy slime rather than incrustation, provided, however, no alkaline salts be present at the same time, as, for instance, common salt; and provided also the pressure of the steam be kept comparatively low, at any rate below 45 pounds per square inch. There have been various means proposed to obviate the incrustation in steam-boilers. Some of these are really useless, or even injurious in many ways. A very useful mixture, which effectually answers the purpose, is the following:—1 hundred weight of catechu; ¼ ditto of common salt, are dissolved in 226 gallons of water (best rain water if it is to be had, or soft clear river water). 10 lbs. of this mixture are daily sufficient to keep a boiler, which has to convert into steam, in 12 hours' time, 400 cubic feet of hard water, free from incrustation. The mixture is best pumped in along with the feed water. If E. J. T. will send his address I will give him a diagram and description of an apparatus never met with in connection with steam-boilers in this country, but very frequently found abroad, where no steam-boilers can be used without being under the supervision of properly qualified officers, and where no water is allowed to be used for steam-boilers but after taking every care with it so as to prevent explosions and accidents.—Dr. A. A.

TO CORRESPONDENTS.

James Y.—The copies cannot be sent, as you neglected to give an address.

J. S. P.—O'Neill's "Dictionary of Dyeing" will probably give you all you want to know. *L'Invention* is a French periodical; it can be ordered through any foreign bookseller.

J. G. Tatters.—Many organic ethereal bodies which contain sulphur, and some which are free from that element, have an offensive odour resembling garlic.

A. B.—We can give no idea of the prices. Your best plan will be to advertise for what you want.

T. W Cowburn.—"Fresenius's Chemical Analysis, Quantitative and Qualitative," published by Churchill.

Communications have been received from J. Lonsdale; W. E. Brennon; D. Forbes, F.R.S.; W. Dennison (with enclosure); F. C. Samuels; Dr. H. Dobell; R. Boyd; G. J. Symons; S. Merrill; H. K. Bamber; W. Whitmore (with enclosure); Dr. Rohrig; J. Ford (with enclosure); D. Wilhelm; R. Oatley; F. Rose; C. P. Bahin; F. Cooke (with enclosure); H. Jackson; Gustav Trouvé; F. Schutzenberger; T. Jones; J. Pearson; M. Morris; J. Grimwood; A. E. Sansom; S. J. Mackie; W. Adams; F. Sutton; F. B. Benger; T. Blair; J. Sutherland; W. A. Ross; F. C. Calvert and Co.; E. Meldrum; Piesse and Lubin; F. Hodgson; D. Knight; W. Paterson; J. Walker; H. B. Condy; P. Squire; J. Frankau and Co.; G. W. Eccles; J. Slater; D. Swan, junior; J. Henderson; R. Warington; J. Young; Dr. Attfield; Liebig Extract Meat Company; E. Wood (with enclosure).

Books Received.—"American Artisan;" "Bulletin de l' Encouragement;" "Journal of Gas Lighting;" "Chemist and Druggist;" "Scientific American;" "American Journal of Mining," "American Gas-Light Journal."

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3191. F. L. de Gerbeth, Haggerstone, Middlesex, "Improvements in treating oils and spirits, and in apparatus to be used for this purpose."—Petition recorded November 11, 1867.

3275. W. J. Coleman, Bury St. Edmonds, Suffolk. and A. Coleman, Lombard Stret, London, "Improvements in the combination and mode of treating and employing certain preparations for various articles of food."—November 19, 1867.

3288. Baroness C. de Lavenant, Brixton Road, Surrey, "Improvements in coating metals and metallic articles for the purpose of protecting or preserving the same from oxidation and decay; also in the materials, machinery, and apparatus to be employed therein."—November 20, 1867.

3295. J. Townsend, Glasgow, N.B., "Improvements in the manufacture of soda and potash."—November 21, 1867.

3307. T. Burchell, Charlmonte Avenue, Kingston, county of Dublin, Ireland, "A new and improved process and machinery for the manufacture of soda-water and other ærated liquids."—November 22, 1867.

3340. J. P. Smith. Glasgow, N.B., "An improved mode of coating and uniting metals with metals."—November 26, 1867.

3360. H. F. Gardner, Boston, U.S.A., "Improvements in the means of, and apparatus for, treating metals and minerals, in order to produce their oxides or other chemical or mechanical combinations, and to separate metals from their ores or from their alloys."—A communication from G. A. Willard, Boston, U.S.A., and W. G. Adams, Franklin, Mass., U.S.A.—November 27, 1867.

NOTICES TO PROCEED.

2142. H. A. Dufrené, Rue de la Fidélité, Paris, "Improvements in preserving iron from oxidation."—A communication from A. Delcelier, Eu, France.

2146. S. Bonsall, Philadelphia, U.S.A., "Improvements in tanning, and in the machinery and apparatus to be employed therein."—Petitions recorded July 23, 1867.

3208. A. F. Gaidan, Nimes, Gard, France, "Improvements in compressed or artificial fuel."—Partly a communication from L. Tresgot, Nimes, Gard, France.—November 13, 1867.

3232. J. Clark, Ph.D., and A. Esilman, Glasgow, N.B., "Improvements in decomposing the sulphides of copper, silver, nickel, cobalt, lead, barium, strontium, and calcium, and obtaining copper, sulphur, and other products."—November 14, 1867.

3275. W. J. Coleman, Bury St. Edmunds, Suffolk, and A. Coleman, of Lombard Street, London, "Improvements in the combination and mode of treating and employing certain preparations for various articles of food."—November 19, 1867.

3295. J. Townsend, Glasgow, N.B., "Improvements in the manufacture of soda and potash."—November 21, 1867.

2180. P. A. Rohart, Rue du Canteleux, Douai, France, "Improvements in the manufacture of gases for the production of light, heat, and motive power, and in apparatus for that purpose."—July 27, 1867.

2198. A. Watt, Putney, Surrey, "An improved fertilising compost."

2200. J. Jones, Little Bolton, Lancashire, "An improved chemical mixture or compound for extinguishing fires and destroying explosive fire-damp in coal mines."—July 30, 1867.

2213. G. Gordon, San Francisco, California, U.S.A., "Improved processes and apparatus to be used in the manufacture of sugar, and in sawing, cutting, or forming the same into cubes for use."—July 31, 1867.

2239. E. A. Kirby, Gordon Square, Middlesex, "An improved system of dispensing medicines and preparing drugs therefor, together with an improved portable miniature dispensary and instrument case applicable to such system."—August 2, 1867.

2264. J. Heaton, Langley Mill, Derbyshire, "Improvements in blast furnaces."—August 5, 1867.

2270. T. Luthringer, Lyons, France, "A new red colouring matter."—August 6, 1867.

2288. A. M. Clark, Chancery Lane, "An improved metallic alloy and in the applications of the same."—A communication from G. A. Schmitte, and H. A. Levallois, Boulevart St. Martin, Paris.—August 8, 1867.

2294. H. A. Avery and G. Penabert, Paris, "The application of a certain vegetable powder for removing and preventing incrustations in boilers.—August 9, 1867.

2337. J. A. Jones, R. Howson, and J. Gjers, "Improvements in puddling and other furnaces employed for melting, boiling, or heating iron."—August 14, 1867.

2685. A. Giegele, Mincing Lane, London, "Improvements in the manufacture of Epsom salts."—A communication from Messrs. Vorster and Gruneberg, Cologne, Prussia."—September, 23, 1867.

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THE CHEMICAL NEWS.

Vol. XVI., No. 421.

ON A NEW CLASS OF BODIES HOMOLOGOUS TO HYDROCYANIC ACID.*

By A. W. HOFMANN, LL.D., F.R.S.

The new cyanides isomeric with the nitriles are not formed exclusively by the action of chloroform on the primary monamines. On perusing the papers describing the examination of the organic cyanides, we see at a glance that the chemists who investigated them have had in their hands at the same time the isomeric cyanides with which I am engaged.

In fact everyone who has distilled mixtures of sulphomethylate, sulphethylate, or sulphamylate of potassium with the cyanide of the same metal, will remember the repulsive odour possessed by the products so obtained. This odour only disappears in proportion as the product is purified, and especially after its treatment with acid, in order to remove the ammonia, and with oxide of mercury to separate the hydrocyanic acid.

Dumas, Malaguti, and Le Blanc, in their researches on the nitriles, mention the insupportable odour possessed by the cyanides obtained by the cyanide-of-potassium process; while the products obtained by the dehydration of the ammoniacal salts by means of phosphoric anhydride have a very agreeable aromatic odour.

In a research made by Mr. Buckton and myself on the transformations of the amides and nitriles under the influence of sulphuric acid, we repeatedly had occasion to prepare acetonitrile (cyanide of methyl) and propionitrile (cyanide of ethyl) by the distillation of a sulphomethylate or sulphethylate with cyanide of potassium. In our paper we mention substances of a formidable odour which appeared in these reactions, and we describe the efforts we made in order to isolate them. But as they are only formed in small quantity, we had to give up the attempt.

Mr. E. Meyer†, who has also been occupied with cyanide of ethyl, but who employed another method of preparation, encountered the same bodies. By acting on cyanide of silver with iodide of ethyl in sealed tubes, he obtained, together with iodide of silver, an unstable compound of cyanide of silver and cyanide of ethyl; and there was formed in the same reaction a liquid of an overwhelming odour. This latter, on distillation, presented the characters of a mixture from which it was impossible to isolate a product with a constant boiling-point. When treated with an acid the odour disappeared, and the solution contained ethylamine which was identified by the analysis of the platinum-salt. These are certainly the characters of the cyanides formed by the action of chloroform on the primary monamines; and it cannot be doubted that Mr. Meyer has had in his hands the ethyl term of the series of cyanides which I am studying, both in the combination with cyanide of silver and in the complex liquid which accompanied it.

If such results did not particularly attract the attention of chemists, it was owing to the fact that the author failed in ascertaining the complementary product of ethylamine, namely, formic acid. Mr. Meyer, besides, states that his research remained unfinished; and thus it will be understood how experiments otherwise so carefully carried out should have fallen into an oblivion from which neither the author nor any other chemist has endeavoured to recall them during the many years which have elapsed since their publication.

In consequence of the examination of the bodies produced by the action of chloroform on the primary monamines, these old experiments have acquired a new interest; and it appeared to me, for more than one reason, that it would be desirable to repeat them, making use of the experience gained by my late researches.

For this purpose I have submitted cyanide of silver to the action of several organic iodides.

The iodides of methyl and ethyl act very slowly on cyanide of silver at the ordinary temperature; but the reaction takes place at the temperature of boiling-water.

After a digestion of about ten hours, the transformation is complete; a brown solid matter is formed, having the appearance of paracyanogen, together with a yellowish oily layer possessing in a marked manner the odour of the isomers of the nitriles.

As several preliminary experiments gave indications of a rather complicated reaction, and as it would have been difficult for me readily to obtain sufficient substance by operating in sealed tubes, I performed the experiment in the amylic series, supposing that the higher boiling-point of the iodide of amyl would render it more easy of attack. My expectation was indeed fulfilled; two molecules of cyanide of silver and one molecule of iodide of amyl act on one another with extreme violence at the boiling-point of the latter. It is convenient to operate on a moderate scale, so as to be carefully protected from the escaping gases, which consist of equal volumes of amylene and hydrocyanic acid, mixed with a small quantity of the cyanide of amyl.

The experiment was made in a retort adapted to the lower end of a condenser, the upper end of which was connected with a series of washing-bottles. In the first a small quantity of cyanide of amyl was condensed; the second contained water intended to absorb the hydrocyanic acid; the third one water and bromine in order to transform the amylene into bromide, of which I was thus enabled to collect a considerable quantity during my researches.

After an hour's digestion, the reaction is finished, and the residue in the retort consists of a dark viscous mass, becoming almost solid on cooling; this is a mixture of iodide of silver and a combination of cyanide of silver and cyanide of amyl. The reaction then takes place according to the equation:—

$$\underbrace{C_5H_{11}I}_{\text{Iodide of amyl.}} + \underbrace{2AgCN}_{\text{Cyanide of silver.}} = AgI + \underbrace{AgCN, C_5H_{11}CN.}_{\text{Compound of cyanide of silver and cyanide of amyl.}}$$

But simultaneously a certain quantity of cyanide of amyl splits into amylene and hydrocyanic acid:—

$$\underbrace{C_5H_{11}CN}_{\text{Cyanide of amyl.}} = \underbrace{C_5H_{10}}_{\text{Amylene.}} + \underbrace{CHN.}_{\text{Hydrocyanic acid.}}$$

This secondary transformation depends principally on the manner in which the operation is conducted; it may give rise to very great loss if the action be rather tumultuous.

It was now necessary to separate the cyanide of amyl from the residue in the retort. Up to the present time I have found no other means of effecting this than by submitting the residue to dry distillation; in this operation a further quantity of hydrocyanic acid and amylene is disengaged, and a liquid distils over, which on rectification boils between 50° and 200°. By submitting it to fractional distillation it was found that the first part still contained a quantity of amylene, whilst the latter products had become inodorous. The intermediate portion, rectified several times, finally exhibited a constant boiling-point between 135° and 137°.

The liquid which distils at this temperature is perfectly pure cyanide of amyl. It possesses all the properties which I have described in my previous communication, and is characterised especially by its odour and by the facility

* Paper sent to the Royal Society during the recess.

† Journal fur praktische Chemie, vol. lxvii. p. 147.

with which, under the influence of hydrochloric acid, it splits into formic acid and amylamine. I have not yet completely examined the products boiling at a higher temperature, but everything seems to show that they consist, partly, at least of caponitrile.

The experiments which I have just described show, in a positive manner, that the same bodies can be obtained by the action of chloroform on the primary monamines, and by the treatment of cyanide of silver with the alcoholic iodides. In the latter process many secondary products are obtained; but by a more complete study perhaps it may be modified so as to diminish their quantity.

However this may be, the study of the action of the alcoholic iodides upon silver-salts deserves to be resumed; and it is very probable that in many cases it will be found that the bodies so produced will be but isomeric with those obtained by the ordinary processes.

For the special researches in which I am engaged at the present time, the observations just described have a particular interest; they permit us, in fact, to produce the isomeric cyanides without first preparing the primary monamines; they are especially important with reference to the generation of the polycyanides. The polyamines, in fact, are little, if at all, known up to the present, whilst the iodides of methylene and ethylene and iodoform are easy to procure.

If I have not yet succeeded in preparing a dicyanide of ethylene $C_4H_4N_2$, isomeric with Mr. Maxwell Simpson's cyanide, it is because I have not had at my disposal a sufficient quantity of ethylene-diamine. I now hope to obtain this body by submitting cyanide of silver to the action of iodide of ethylene.

In conclusion, I may be permitted to announce as very probable the existence of a series of bodies isomeric with the sulphocyanides. Already Mr. Cloez has shown that the action of chloride of cyanogen on ethylate of potassium gives rise to the formation of an ethylic cyanate possessing properties absolutely different from those belonging to the cyanate discovered by Mr. Wurtz. On comparing, on the other hand, the properties of the methylic and ethylic sulphocyanides with those of the sulphocyanides of allyl and phenyl, we can scarcely doubt that we have here the representatives of two groups entirely different, and that the terms of the methylic and ethylic series, which correspond to oil of mustard and to the sulphocyanide of phenyl, still remain to be discovered. Experiments with which I am now engaged will show whether these bodies can be obtained by the action of the iodides of methyl and ethyl on sulphocyanide of silver.

I must not conclude this note without expressing my thanks to Messrs. Sell and Pinner for the hearty co-operation that they are giving me in these researches.

CARBOLIC OR PHENIC ACID AND ITS PROPERTIES.*

By Dr. F. CRACE CALVERT, F.R.S., &c.

(Continued from page 298.)

I shall now have the pleasure of calling your attention to the production of two new colouring substances derived from picric acid:—

1. Picramic acid was, in the first instance, obtained by Wœhler; by making sulphate of iron act upon picric acid, and neutralising with caustic barytes, when a deep brown salt was produced, from which he separated the baryta by the help of sulphuric acid, and by these reactions M. Wœhler obtained an acid to which he gave the name of nitro-hematic acid; but it is to M. Aimé Girard that we owe the practical process by means of which we are able to manufacture great quantities of picramic acid. This acid imparts to silk a beautiful series of brown tints similar to those obtained from catechu.

2. Isopurpurate of ammonia. It is with much pleasure that I noticed, at the Exhibition, in M. Casthelaz's case, a coloured substance, known in the trade by the name of soluble garnet, which, I am informed, is used especially by M. Chalamel, of Puteaux; this substance is particularly remarkable, as it is isomeric with the *purpurate of ammonia or murexide*. Although the preparation of this material was first pointed out by M. Carey, still it is really due to a previous observation, by Hlasiwitz, who called attention to the reaction of cyanide of potassium upon picric acid, and to which chemical reaction we owe the knowledge of manufacturing the isopurpurate for industrial purposes.

Before taking leave of picric acid it may not be without interest that I should state a curious application which has been made of the explosive property of its salts. During these last few years the picrate of potassium has been employed in great quantities by Mr. J. Whitworth, for charging the bombs for destroying the iron plating of ships. When the projectiles thus prepared strike the iron masses, the enormous propelling force with which they are expelled from the gun is instantaneously converted into heat, and to such an extent that the ball becomes red-hot, the heat decomposes the picrate of potash, and a violent explosion ensues, owing to the enormous quantities of vapours and gases which are thus produced in an instant of time. Whilst the alkaline picrates are endowed with such formidable properties, they also possess others which are useful for the alleviation of human misery. Picric acid is an efficacious remedy in intermittent fevers. Persons affected with such types of fever, upon whom quinine has lost all its beneficial effects by continuous usage of it—and this is the case with some of our soldiers who return from India—derive, I am glad to say, wonderful benefit from the use of picric acid and picrates, as Dr. Aspland has proved to be the case at the military hospital at Dukinfield. The knowledge of this fact may be useful in districts in which poor populations exist, for it affords them a cheap febrifuge; and, morever, picric acid is not dangerous, as arsenical preparations are, nor does it derange the stomach like quinine.

To return to the colours derived from carbolic acid. allow me to remind you that when, in 1834, Runge discovered phenic acid amongst the products of coal-tar, he observed the existence of two colouring substances, to which he gave the name of rosolic acid and brunolic acid.

I will not detail here the processes by which Runge extracted these substances from the residue of coal-tar by means of lime, nor the method adopted by Messrs. Smith, Dussart, and Jourdin, for producing these substances by direct oxidation of phenic or carbolic acid, but will describe rapidly the process which we now use to manufacture rosolic acid, and which should not be attributed, as is generally believed, to M. Kolbe, as it is due to M. Jules Persoz, the son of the celebrated professor of tinctorial chemistry in the Conservatoire des Arts et Métiers. His process consists in making oxalic acid act upon sulphophenic acid at a temperature of about 160°, and the product which results from it has the bronze green appearance of cantharides. To render it suitable for employment in dyeing, it is only necessary to wash it so as to separate from it all the sulphuric acid with which it is contaminated. It is then sold under the name of yellow coralline or aurine. It was our firm who first, in 1863, discovered that rosolic acid thus prepared could be employed directly as a dye, and introduced it to dyers under the name of aurine. This substance gives to silk and albumenised cotton magnificent orange colours, like those of basic chromate of lead or of turmeric. In 1860, M. Persoz, jun., discovered also that if rosolic acid was heated under pressure with ammonia it gave rise to a red substance, which he called *péonine*. Messrs. Guinon, Marnas, and Bonnet perfected the manufacture of *péonine*, and gave it

* Lecture before the Society for the Encouragement of National Industry in France.

the name of red coralline. This colouring substance gives to silk and worsted a flame-coloured tint and brilliant scarlets. This firm was also the first to produce and introduce, towards the end of 1860, a blue dye, derived from carbolic acid, or, more so, resolic acid, which they called azuline. Azuline is obtained by heating for several hours, at a temperature of about 180°, a mixture of rosolic acid and aniline. It is only necessary then to treat this product with sulphuric acid, and to wash it with benzine, to produce a beautiful blue colouring matter, which presents, when dry, a red mass with gold-coloured tints. Azuline, although discovered before the aniline blues, which have since become formidable rivals to it, is still, I may add, manufactured in competition with them.

To Messrs. Guinon, Marnas, and Bonnet is also due the first production of a green derived from coal-tar products. It was manufactured in 1863, therefore some months before the appearance of an aniline green, known as *vert d'Uzebe*, which, however, with the exception of the iodine greens, is the only one now employed in dyeing. Viridine was obtained by this firm from a mixture of aniline, benzoic, and resolic acids.

Phenicienne, discovered in 1863 by M. Roth, is another colouring matter derived from phenic acid; it produces fast colours, from a deep garnet red to a golden buff. Phenicienne is produced by the action of nitrosulphuric acid upon carbolic acid.

I will now, with your permission, gentlemen, leave for a few seconds the products derived from phenic acid, in order to place before you certain claims to some inventions not sufficiently recognised by writers on aniline colours. In 1860, Messrs. Clift, Lowe, and I, took out a patent for the direct production on prints, of a green called emeraldine, and the deep blue called azurine, a blue which resembles indigo, and which really, when printed in a concentrated form, may be confounded with a black. And although I do not desire to deprive Messrs. Lightfoot, Carlos Kœchlin, and Lauth, of any of the merit which belongs to them for the production of the beautiful black which every one must have admired in the Exhibition, still I may be permitted to remark that their process is based upon the oxidation of aniline by chlorate of potash, and is therefore based on our patent, previously secured to their discoverers. The difference between their process and ours consists in the addition of a salt of copper, which addition is so important that I have no hesitation in saying it has decided the success of a black which now stands unrivalled.

I cannot conclude this retrospective view without calling your attention to a fact which seems to have escaped my colleagues; it is that the majority of the beautiful colours obtained from aniline are due to the industrial application of a discovery made by your illustrious president, M. Dumas, more than thirty years ago. The discovery I mean is the principle, so rich and fruitful, which he named the law of substitutions—a law which has thrown so bright a light on modern chemistry, and which has prepared the way for such brilliant achievements, and which, I say, has also been the foundation of the production of the beautiful colouring substances which we all so much admire. Thus, in order to obtain aniline blues, violets, and greens, produced by the methods devised by the illustrious chemist, Dr. Hofmann, we substitute for a certain proportion of the hydrogen of rosaniline, an equivalent quantity of the alcoholic radicals, called phenyl, ethyl, methyl, and amyl. Further, this celebrated chemist has also shown that the blue obtained by Messrs. Girard and Delaire are also due to the same laws.

I am far, I regret to say, gentlemen, from having named all the remarkable properties and applications of carbolic or phenic alcohol; but I trust I have succeeded in making you share my enthusiasm for this valuable agent, which, after having rendered important services to most of the world's industries, still offers to chemists and to manufacturers a wide field for new applications.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, December 19.

Dr. Warren De la Rue, F.R.S., &c., President, in the Chair.

The minutes of the previous meeting were read and confirmed. Messrs. Alfred Coleman and A. A. Wood were formally admitted Fellows of the Society; and Dr. W. F. Smith, Glossop Road, Sheffield, and Mr. Alfred E. Fletcher, Inspector of Alkali Works, Johnston, near Prescot, were duly elected.

The names of candidates read for the first time were—Herbert M'Leod, Assistant Chemist in the Royal School of Mines, 61, Bridge Street, Southwark; Thomas Charlesworth, Leicester; Robert Schenk, 10, Hanover Place, Kennington; and John Wallace Hozier, B.A., Oxon, Lieutenant 2nd Dragoon Guards, Staff College, Sandhurst.

For the second time were read the names of the following:—Peter Greiss, Burton-on-Trent; Gilbert W. Child, M.D., St. Giles', Oxford; Edward Chapman, Lecturer in Natural Science at Merton College, Oxford, (Frewen Hall, Oxford); William George Mason, Escrick, near York; and Alexander Walker, Captain Royal Artillery, Bengal Presidency, 18, Sussex Place, South Kensington.

Mr. Alfred Tribe then read a short paper "*On the Freezing of Water and Bismuth.*" The author quoted an extract from Professor Tyndall's "Heat as a Mode of Motion" (page 84), in which it is asserted that the anomalous expansion of water in the act of cooling below 4°C. is by no means an isolated instance of the kind, but that other bodies, and particularly molten bismuth, participate in this extraordinary property of expanding near the point of solidification. After making experiments upon this subject, Mr. Tribe arrives at the conclusion that the analogy between water and bismuth is imperfect, since in the case of the molten metal there is no perceptible range of temperature through which it expands on cooling. The act of solidification is itself accompanied by an increase in bulk, but there is no evidence of this expansion taking place prior to the act of crystallisation.

After a few words in support of Mr. Tribe's conclusion had been offered by Dr. J. H. Gladstone, the President, at an early hour, moved the adjournment of the meeting for the purpose of enabling the members to be present at the delivery of the Bakerian lecture before the Royal Society. Dr. Roscoe, the lecturer, described his recent "*Researches on Vanadium.*"

At the next meeting, January 16, Dr. Frankland will deliver a discourse "*On Water Analysis;*" and on February 6, Dr. Russell, "*On Gas Analysis.*"

DUBLIN CHEMICAL AND PHILOSOPHICAL CLUB.

Dec. 12, 1867.

"*The Action of Ozone on Sensitive Photographic Plates.*" Dr. Emerson Reynolds stated that he had been performing some experiments upon the above subject, and that he had found that when the latent image (*i.e.*, the image before it is developed) was submitted to the action of ozone, it was completely obliterated—not only was it impossible to develop the image, but a second image might be retaken in the camera upon the same plate. The author remarked that this was against the theory which might be called the mechanical theory of photographic

images, and proved conclusively that it was due to chemical change in the sensitive film. He also thought that many of the disputes in connection with the length of time dry plates might remain sensitive, was probably owing more or less to the quantity of ozone present in the air.

The ozone used in these experiments was in some cases procured by passing atmospheric air over phosphorus, and in others by the silent discharge, viz., by attaching one of the platinum wires of the reservoir to the prime conductor of a machine, and turning it slowly, the other wire being in communication with the ground.

"*Nitrite of Amyl.*"—Mr. Tichborne brought before the notice of the meeting a statement by Mr. Chapman, which appeared in the *Laboratory* of August 31, namely, 'that nitrite of amyl was not decomposed by heat, as stated by Mr. Tichborne. The speaker had not considered the matter of sufficient importance to enter into a written dispute with that gentleman, but felt that it was due to the members of the society to prove that Mr. Chapman was in error, more particularly from the fact that the observations, to which Mr. Chapman took objection, were first brought forward at one of their meetings of the previous session. Mr. Tichborne said his note was merely published with a view to correct some erroneous descriptions of nitrite of amyl which were given in the manuals of chemistry. The speaker found that the redness of the vapour (described as a specific property of nitrite of amyl) was due to a partial dis-association of the elements and the consequent elimination of binoxide of nitrogen.

Mr. Chapman, on the contrary, "was of opinion that nitrite of amyl was an ether of great stability." "That when once obtained tolerably pure it would bear distillation without undergoing any appreciable decomposition." Now, although Mr. Tichborne had no doubt that Mr. Chapman's general observations in connection with this substance were very exact, he was compelled to take exception to this point. He found that the perfectly neutral nitrite became instantly acid on ebullition, and gave off binoxide of nitrogen; that this decomposition which was however comparatively partial, continued during the whole of the distillation, and was as decided at the conclusion of the operation as at the commencement. Also that pure nitrite of amyl by spontaneous decomposition became acid and charged with oxides of nitrogen. Mr. Tichborne then showed an experiment which illustrated and conclusively confirmed his remarks.

A sample of nitrite of amyl was taken which had been made after the plan recommended by Mr. Chapman, viz., by passing nitrous acid through amylic alcohol, the latter having been previously purified by fractional distillation; it had been treated with dry carbonate of sodium, and was therefore quite free from the acid products of decomposition. Half of the specimen was poured into a solution of starch and iodide of potassium; no change was manifested, showing that the specimen was free from any absorbed binoxide of nitrogen*. The other half of the specimen was then placed in a small retort, the vapour from which was passed through the same mixture of iodide of potassium and starch. Heat having been then applied to the nitrite of amyl in the retort, the first puff of gas that escaped through the mixture instantly determined a copious deposition of blue iodide of starch.

Dr. Frazer, in showing some interesting minerals, remarked that glycerine would be found to be a very useful material for preserving lanmonite (efflorescing zeolite) and such like minerals that lose their water of hydration. Thus he had kept specimens for years by smearing them with a little glycerine, and what would naturally be destroyed in a short time when placed dry in a cabinet, were by this means kept perfectly safe.

* Nitrite of amyl absorbs binoxide of nitrogen very readily, and when first prepared is more or less charged with this gas. "Probably these circumstances induced Mr. Tichborne to regard the ether as decomposable on boiling."—*Vide* Mr. Chapman's note in *Laboratory*, August 31, 1867.

A LECTURE EXPERIMENT.

The presence of earthy or alkaline carbonates in spring or river water, &c., may readily be shown by adding a small quantity of a freshly prepared decoction of logwood, when a more or less deep purplish-red colour is produced. With distilled water only a slight reddish-yellow colour is observed. The experiment may conveniently be performed by adding an equal quantity of the logwood solution to the water or waters to be tested, contained in glass jars or beakers, placed on white paper, a similar jar of distilled water being used for comparison. The solubility of carbonate of lime in pure water, may be shown by placing some pulverised calc-spar on a properly purified filter and allowing distilled water to pass through it; on adding a few drops of the logwood solution to the filtrate a deep purplish red colour is immediately produced. An alcoholic solution of alizarine may be used instead of the logwood decoction; with distilled water a yellowish colour is produced, but if any alkali or alkaline earth be present, a violet colour is developed, especially on application of a gentle heat. Of course in using the above tests to show earthy carbonates in water, care must be taken that no alkali is present. J. W. Y.

MISCELLANEOUS.

Royal Institution.—Professor Tyndall, F.R.S., will deliver juvenile lectures on "Heat and Cold," on Tuesday, Thursday and Saturday next, at three o'clock.

Science as a Part of Education.—The following is the concluding passage of the last of a course of chemical lectures recently delivered at Eton College by Mr. G. F. Rodwell:—"In conclusion, let us consider the nature of the various processes which we have studied. Let us enquire by what means we have been enabled to produce the different chemical changes which have been brought before us. These changes have been effected by inducing in matter unnatural and forced conditions; by influencing substances either externally or internally by superadded actions; or by the removal of a prevailing force which prevented the prominent assertion of chemical affinity. '*Occulta naturæ*,' says Francis Bacon, '*magis se produnt per vexationes artium, quam cum cursa suo meant.*' From the beginning to the end of this course we have extracted our knowledge by thus harassing and vexing nature. The tearing asunder of combined atoms; the separation of atoms from one form of combination, and the compelling them to unite otherwise; the addition or subtraction of vibrating motion. These are the actions which have enabled us to gain some insight into the working of the force called chemical affinity. Of the actual nature of chemical affinity we know nothing; we can only regard it as an attractive force exerted between dissimilar atoms, acting through an insensible space, and varying in intensity as the atoms vary in composition. Chemical affinity can only be studied through its actions, and the greater number of the processes which we have employed have been for the purpose of eliminating the action of certain forces so as to cause chemical affinity to be the dominant force during the continuance of the experiment. These studies are to be viewed as a means to an end. The primary object of science teaching is not to make you acquainted with its applications to the useful purposes of life, but to induce in you that exact and discriminative mode of thought which is inseparable from the right study of physical phenomena. Why I say that to thoroughly master the vibratory motion theory—theory though it be—as applied to the explanation of chemical phenomena, is better, as a mental exercise, than the knowledge of fifty of the applications of chemistry. Do not let your science be of too practical a character. Remember that science applied

to the useful arts—to the making of dyes, the extraction of metals, the manufacture of coal-gas—has ceased to be pure science. It is not such science as this that I would have you study. True science must have as its primary objects the search for truth, the investigation of causes, the enlargement of our knowledge of the various agencies which are at work around us. It is to be built up mainly of well-verified experimental facts and of theories readily deducible from them. The former are to be received as absolute ; the latter as liable to change. That such change is inevitable will be obvious when we remember that in the present state of science we are all—both those who theorise and those who work out the facts upon which theory is supported—all alike are boys, and listeners, and learners in the school of nature."

Counterfeit Creosote.—A large proportion of ordinary creosote is simply carbolic acid. But the pure creosote, which constitutes the lachrymosal property and peculiar smell of smoke, is quite a different substance, and may be distinguished from the false, as shown by Rust, by its behaviour with collodion. A mixture with this latter and carbolic acid gives a gelatinous precipitate, while with true creosote the collodion remains clear. Dr. Hager gives another test. To a weak solution of iron, a few drops of ammonia are added until the precipitate, which originally forms, is dissolved. Carbolic acid communicates a blue or violet tinge to the solution, while genuine creosote gives a green colour, afterward turning to brown. —*Scientific American.*

Dessicated Egg.—Mr. Charles Lamont has discovered and patented a very ingenious process for preparing eggs so that they may be kept for years without change or decay. The process consists in emptying the fresh eggs from the shell into a long covered trough; a shaft, armed with a series of metallic discs about 15 or 20 inches in diameter, is made to descend into this trough while revolving, which beats the eggs into homogeneousness, and covers the surfaces of the discs with a thin covering of egg. The discs still revolving are elevated from the trough, and a current of hot air passed through the covered box, which quickly dries the egg, when a series of scrapers are brought into action so as to scrape off the egg in the form of fine thin scales or granules, which have the appearance of being crystallised. This process may be repeated *ad libitum*. The preparation thus obtained retains, perfectly, all the properties and flavour of the fresh egg, and may be used for the various purposes where broken egg is needed, and for cooking, by dissolving a little in water and beating it as usual. One pound is equal to 44 eggs ; 100 doz. eggs, when crystallised or dessicated, occupy one cubic foot. We are glad that this very useful article of diet has been added to the now long list of preserved articles of food. An enterprising company in New York have, we understand, purchased the invention, and it is now being successfully introduced into the market.

Crystallisations Produced by Means of the Blow-pipe.—It sometimes happens in experiments with the blow-pipe, when borax, phosphorus, salt or soda is used, that the bead, at first limpid, becomes suddenly opaque. M. G. Rose finds that this is due to the development of crystallised bodies in the interior of the mass. The crystallisation is often confused, although sometimes it is very regular, and on operating with titanium under sufficiently varying circumstances, M. Rose has been able to obtain anatase, and to effect the crystallisation of the two allotropic states of the titanic acid. With felspar and phosphorus salt (by the aid of which, as is well-known, silicates are reduced to silica and phosphates) he obtained crystallised quartz, confused, but insoluble in alkalies. In order to recognise the crystals obtained under these conditions, flatten the yet warm bead and observe it under a microscope, or it may be attacked by water or an acid, in which case the residual crystals may be collected on a glass plate.

Diffusion.—Some very elegant and simple methods of exhibiting the phenonema of diffusion are given by Herr Merz in a recent number of the *Journal für Praktische Chemie*. A portion of the shell of an egg having been removed by the action of hydrochloric acid, leaving the membrane exposed, the egg is to be suspended in water from the arm of a balance, a counterpoise being placed in the opposite scale. In about half an hour the weight of the egg has sensibly increased, as the position of the balance-beam will show, in consequence of the passage of water through the membrane. If, now, alcohol be substituted for the water, and the weights readjusted so as to bring the beam horizontal, it will soon commence to move in the opposite direction, showing that the egg has become lighter by the diffusion of water into the alcohol. The diffusion of vapour may be exhibited by tying a diaphragm of india-rubber—a portion of a small toy balloon will answer the purpose—over the mouth of a funnel, the other end being in communication, by means of an elastic tube, with a vessel of water. The funnel being inverted over a dish containing ether, which, however, the diaphragm is not to touch, the vapour of this fluid will pass rapidly into the funnel, the air being observed to escape in bubbles in the water at the small end. Remove now the vessel of ether, and the operation will be reversed, the vapour passing through the diaphragm into the atmosphere. In order to fill the vacuum thus created the water will rise in the tube, the lower part of which should be of glass to render this apparent, and the diaphragm will be curved inwards. These experiments are particularly instructive, and are within reach of every one. The balance may be extemporized by means of a light bar of wood.

Microscopic Crystallography.—Mr. H. S. Waddington, in a paper read before the Pharmaceutical Society, and published in the *Journal*, says that the formation of perfect crystals depends upon the rapidity with which they are deposited. He has obtained better results by allowing the crystals to deposit from a hot and concentrated solution, than placing a few drops of a cold saturated solution on a clean slide, and allowing it to evaporate spontaneously. When crystals are pretty soluble in water, the way of procedure is as follows :—A solution is made in hot distilled water, the liquid filtered, and a few drops poured on to a clean slide just before the crystals begin to form in the solution itself, and immediately poured off, sufficient will remain behind for the production of crystals, which will form at once. When of a sufficient size, the remaining liquor, if any, should be drained from them and the slide allowed to dry. The result will generally be a slide, evenly covered with crystals, having well-defined edges, and but few of which are agglomerated. This process answers well for alum, chlorate of potassium, nitrates of barium and strontium, potassio-tartrate of antimony, sulphate of copper, sulphate, acid tartrate, binoxalate, and quadroxalate of potassium, the strength being regulated by experience. If crystals are not very soluble in cold water, they may be allowed to separate in the bulk of the solution itself as it cools, then remove a small quantity of liquid and crystals to a slide by means of a glass tube. The slide must be kept moving to prevent the aggregation of the crystals, and the superfluous liquid removed by applying blotting paper to the edges of the slide. To obtain perfect crystals from substances generally met with in long prisms, Mr. Waddington finds the best method is to make a hot solution, containing rather more of the salt than would saturate it at ordinary temperatures. Having filtered and allowed it to become nearly cold, place a few drops on a slide, and draw a very fine glass rod across it. This method overcomes the difficulty of producing typical crystals. For hippuric acid, the solution, when on the point of crystallising, should be poured on to a cold slide, and when the crystals have formed, the remaining liquid should be poured off and the slide allowed to dry. Sugar, citric and tartaric acids, and all substances very soluble in water, may be obtained in crystals by making a concentrated solution, filtering it, and then

pouring on to a slide, taking care that only a thin layer of liquid remains, which should be allowed to dry in the air. To obtain crystals from sulphate of iodo-quinine or "Herapathite," the author mixes 3 drachms of spirit of wine and 1 drachm of acetic acid in which he dissolves 10 grains of bisulphate of quinine. He then pours 10 or 15 drops on to a slide and adds a drop of tincture of iodine. When clear he pours it from slide to slide as long as the liquid holds out. The best method of obtaining uric acid in crystals is to allow 8 or 10 oz. of urine to stand some hours after the addition of 2 or 3 drachms of acetic acid. In a day or two the crystals will have grown larger, when the bottle should be shaken to detach them from the sides, and then wash them with distilled water, acidulated with acetic acid. To obtain the rarer forms it is requisite to allow the crystals to deposit quickly, which may be done by making a solution of urate of sodium by boiling uric acid with solution of caustic soda until no more is taken up. If 1 or 2 drachms of this is put into 8 oz. of urine and a small quantity of acetic acid added, not more than sufficient to neutralize the soda, very perfect crystals will be obtained. Another deposit found in urine is the phosphate of ammonium and magnesium, or triple-phosphate, which may be prepared in prisms by dropping about 25 or 30 grs. of carbonate of ammonium into 8 or 10 oz. of urine, and allowing it to remain quiet for some hours. When the crystals are of sufficient size the bottle may be gently shaken and the urine poured off. This deposit may also be obtained in stellate crystals by adding 1½ to 2 drachms of carbonate of ammonium to urine, and allowing it to stand. The crystals should be washed with distilled water, to which a little liquor ammoniæ has been added. Calcic oxalate may be obtained by dropping a single small crystal of oxalic acid into 8 or 10 oz. of urine, and leaving it at perfect rest for some hours. Mr. Waddington has also obtained good results from salicin by pouring a saturated solution in cold water on to a slide, holding it over a flame until it is at the boiling point; then pouring off the slide, when only a viscid film will remain. This must become quite cold, and the under surface held close to the flame of a lamp or gas jet. The moment it begins to crystallise it must be removed a few inches from the flame, or else it will fuse.

Royal Polytechnic Institution.—The Christmas entertainments at this Institute were inaugurated on Saturday evening last with a grand dinner, followed by a conversazione. The company at dinner, included the following noblemen and gentlemen:—His Highness Prince the Maharajah Duleep Singh; his Grace the Duke of Wellington, K.G.; Viscount Strangford; the Rt. Hon. Lord Ernest Bruce; Capt. the Hon. F. Maude; Hon. A. Kinnaird, M.P.; Professor Wheatstone, F.R.S.; Professor Abel, F.R.S.; Erasmus Wilson, F.R.S.; Professor Pepper; Dr. Letheby; Wm. Crookes, F.R.S.; Robert Hunt, F.R.S.; Rev. J. B. Owen, M.A.; Professor Graham, F.R.S.; J. Glaisher, Esq; J. Spiller, Esq., &c. The conversazione was very numerously attended, and the varied entertainments for the holiday season were rehearsed. Professor Pepper delivered a lecture on "Faraday's discoveries and their results, being real science as contrasted with unreal science called spiritual manifestations." Commencing with the discovery of bicarbide of hydrogen, the lecturer spoke of Dr. Hofmann's researches on benzol, which had been the means of producing the colours mauve and magenta since manufactured on a very large scale by the firm of Nicholson and Maule. He then dwelt upon Faraday's discoveries in electricity, explaining the construction of Wheatstone's bridge, &c. Mr. Apps also exhibited his new induction coil, with which a spark about four inches in length was obtained and other brilliant experiments performed. The lecture was closed with some extracts and observations on spiritualism, when Professor Pepper stated that Dr. Bence Jones had lent him a manuscript, which he had received from some one who professed to have held communication with Faraday's spirit, and that the latter was now a firm believer in spiritual manifestations, and regretted he had not taught the truth when he was alive. During the evening the Polytechnic was placed in telegraphic communication with the United States, Paris, Manchester, &c., and the visitors were amused by receiving the following message from Newfoundland two or three minutes after its transmission:—"Temperature, 19° Fahr., wind, N.E., snow drifts in some places nearly 20 ft. deep." Mr. Ladd's dynamo-electric machine, machine-made jewellery, and various other ingenious novelties are introduced into the programme. We have no doubt the Institution will be well attended during the holidays; the programme is a very long one, and many other novelties are promised.

To Cement Brass on Glass.—Puscher uses a cement particularly adapted for fastening brass on glass lamps, which consists of a resin soap—made by boiling three parts of resin with one part of caustic soda and five parts of water—which is mixed with one-half its weight of plaster-of-paris. This cement has great adhesive power and is not permeable by petroleum; it sets firmly in less than an hour, and is a very slow conductor of heat. Zinc-white, white-lead, or precipitated chalk may be substituted for plaster of Paris, but the material will be longer in hardening.—*American Artisan.*

Iodine and Carbolic Acid.—Dr. Percy Boulton, to remedy the inconvenience attending the external application of iodine and its preparations, has adopted the method of adding a few drops of carbolic acid to the iodine solution to be employed. The formula is as follows: Compound tincture of iodine, 3 grms.; pure liquid carbolic acid, 6 drops; glycerine, 30 grms.; distilled water, 150 grms. This carbolate of iodine is not perfectly colourless, so that it may be applied with impunity; and it is not only one of the most powerful antiseptics we possess, but is intrinsically a more efficacious agent than iodine alone. In the form of injections, gargles, and lotions, for sore-throat, ozœna, abscess in the ear, &c., this preparation is a sovereign remedy.—*Extract from a letter in the Journal des Connaissance Médicales.*

New Test for Molybdenum.—In a former paper I stated that under certain circumstances sulphocyanide of potassium produced a magnificent red colour with molybdic acid. I have since thought to use this reaction as a test for the presence of molybdenum, and I find it extremely delicate, far more so than any other test yet employed.

Thus, molybdic acid dissolved in hydrochloric acid, and treated with sulphocyanide of potassium, gave the following results, when progressively diluted and shaken up with scraps of zinc.

Degree of Dilution.	Degree of Coloration.
One part molybdic acid in .. 50,000	Dark.
" " " " .. 150,000	Pale.
" " " " .. 300,000	Very pale.
" " " " .. 600,000	Faint.
" " " " ..1,000,000	Colour perceptible in small bulk.
" " " " ..2,000,000	Colour perceptible only in large bulk.

The presence of sesquioxide of iron does not interfere with this test if time is allowed for its deoxidation.

Tungstic acid similarly treated also gave a magnificent red or yellow colour, which however is not superior as a colour test to that at present used.—*William Skey, New Zealand.*

NOTICE.

With this number the present volume closes, and we have pleasure in informing our readers that in our next number, commencing volume XVII., *will be published a verbatim report of the first of Professor Tyndall's Christmas Lectures at the Royal Institution, "On Heat and Cold." Other new features will also be gradually introduced into our pages during the ensuing year.*

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